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Nuclear Science Abstracts

Containing Abstracts on Atomic Energy
in the Fields of

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Metallurgy
Chemistry
Engineering

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NUCLEAR SCIENCE ABSTRACTS

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ERRATUM

In NSA 5-787(1951), the author's name should be Anthony B. Marmo instead of Anothony B. Marmo.

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AECU-1051	Thermal Neutron Time-of-Flight Velocity Selector. (abstract) F. G. P. Seidl, H. Palevsky, R. F. Randall, and W. Thorne.	1307
AECU-1052	Inelastic Scattering of Low Energy Neutrons in Graphite. (abstract) G. W. Johnson, H. Palevsky, and D. J. Hughes.	1371
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AECU-1066	Particle Localization by Means of a Scintillation Detector. Luke C. L. Yuan and H. L. Poss.	1308
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MITG-A-70	New Fluorimeters for the Determination of Uranium; MIT Models I, II, III, and IV. David Kaufman, Mario Castillo, and Urpo Koskela.	1218
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NYO-835	The Corrosion of Zirconium; First Quarterly Report. Harold J. Read.	1263
ORNL-844	Physical and Chemical Factors Modifying the Sensitivity of Cells to High Energy and Ultraviolet Radiation. Alexander Hollaender.	1157
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UCRL-943	Angular and Radial Distributions of Particles in Cascade Showers. L. Eyges and S. Fernbach.	1280
UCRL-988	The Production of π^+ Mesons by Protons on Protons in the Direction of the Beam. (abstract) W. F. Cartwright, C. Richman, M. H. Whitehead, and H. A. Wilcox.	1323
UCRL-995	Angular Distribution of Gammas in Showers. (abstract) Jack W. Rose.	1376
UCRL-999	Protons Scattered Out of Nuclei at High Energies. (abstract) J. B. Cladis, J. W. Hadley, and B. J. Moyer.	1377
UCRL-1002	Large Angle Focusing of π^+ and π^- Mesons. R. Sagane and Peter C. Giles.	1324
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UR-132	Spectrophotometric Studies of Uranyl:Citrate System in Acid Solution. I. Feldman and W. F. Neuman.	1249
UR-140	The Influence of Infection on the Hematological Effects and Mortality Following Mid-Lethal X-Radiation. L. R. Bennett, P. E. Rekers, and J. W. Howland.	1158

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AERE-Med/R-562	A Method of Preparing a Model Showing Surface Detail of the Terminal Phalanx of a Finger. W. Graham-Smith, M. McCarthy, R. H. Brown, and T. Dyke.	1170
CRT-393	Critical Radius of a Multiplying Spherical Core Surrounded by a Non-Multiplying Reflector of Finite Thickness. G. Volkoff.	1357
NP-1603	An Unsteady-State Method for Measuring Thermal Diffusivity at High Temperatures. Herman S. Levine.	1251
NP-1677	The Production of a Charged Meson by an Electron; Technical Report No. III. Synchrotron Project. Ellis Strick.	1327
NP-1818	The Vapor Pressure of Inorganic Substances; V. Zirconium between 1949° and 2054°K; Technical Report No. 7. Gordon B. Skinner, James W. Edwards, and Herrick L. Johnston.	1269
NP-1836	Preparation of Single Crystals of Beryllium and Zirconium; Study of Mechanical Properties; Quarterly Report; July 1, 1950, to September 30, 1950. R. M. Brick, H. T. Lee, and H. Greenewald.	1266
NP-1881	Metallurgical Investigations Concerned with the Behavior of Materials in an Environment of Liquid Lead-Bismuth Alloy. R. C. Grassi, D. W. Bainbridge, R. O. Elliott.	1265
NP-1910	Nuclear Physics, Chemical Corps School, Army Chemical Center.	1336
NP-1914	Radiological Defense Officers Course; Laboratory Manual. Chemical Corps School, Army Chemical Center.	1185

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NP-1921	Internal Conversion Data. P. Axel and R. F. Goodrich.	1346
NP-1931	Precision Magnetic Field Regulation Using Nuclear Magnetic Resonance; Technical Report No. 1-6663. Frederick Alan Hadden.	1297
NP-1933	Vapor Pressure of Inorganic Substances; V. Tantalum between 2624 and 2943°K. Technical Report No. 6. James W. Edwards, Herrick L. Johnston, and Paul E. Blackburn.	1268
NP-2233	A Contribution to the Study of the Composition of Cements; Calcium, Strontium, and Barium Cements; trans. from Bull. sect. sci. acad. roumaine 30, No. 9, 1-7(1949). A. Braniski.	1398
NP-2236	The Absolute Quantitative Determination of Actinium by the Emanation Method; trans. from Akad. V. I. Vernadskomu k Pyatidesyatiletiyu Nauch. Deyatelnosti 1, 499-516(1936). V. I. Baranov.	1219
ORNL-97-50	Conference on the Properties of Semi-Conducting Materials, University of Reading, England, July 10-15, 1950. P. W. Forsbergh, Jr., and P. M. Marcus.	1278

GENERAL

ATOMIC BOMBS AND WARFARE

1151

ATOMIC BOMB EFFECTS. Edward J. Kehoe. ASTM Bull. 170, 16-17(1950) Dec.

An extended abstract from a talk describes the bombing effects at Hiroshima and Nagasaki and discusses effects of the three types of atomic bomb bursts, i.e., in the air, under ground, and under water.

1152

HOW TO SIZE UP THE ATOM BOMB — PART 3. Philip W. Swain. Power 95, No. 1, 3, 82-8(1951) Jan. (See also NSA 5-283)

It is widely agreed that a high air burst is more effective against land targets than a low burst or one beneath the surface of an adjacent river or harbor. Consequently these studies have been mainly concerned with an air burst 2000 to 2500 ft above ground. For this most destructive detonation level, the only radiations that need be considered are shock wave, thermal radiation, and γ rays. This concluding article describes how shock wave, flash, and γ rays act on people and on structures.

1153

NEW PROBLEMS CONFRONT ATOMIC SCIENTISTS. Rudolf Hanslian. Chem. Ztg. 74, 706-9(1950) Nov. 23. (In German)

This is a reproduction of a chapter from a new popular book "From Gas Attacks to Atomic War" (Berlin, Apotheker- und Chemiker-Verlag, 1950, 150 p., in German). The story of the work on the atomic reactor and the atomic bomb in Germany and in the United States during the last war is told. Even before the destruction of the heavy-water plant in Norway by the British Air Force in the fall of 1943 the bomb project had been recognized (on June 6, 1942) by the German government as financially unattainable.

BIOLOGY AND MEDICINE

1154

Duke University
THE EFFECT OF PARATHYROID EXTRACT ON RENAL EXCRETION OF PHOSPHATE. Philip Handler, David V. Cohen, and W. J. A. De Maria. [nd.] 39p. (ORO-18)

Following the intravenous injection of commercial parathyroid extract to dogs, a marked increase in GFR (glomerular filtration rate) and RPF (renal plasma flow) was observed. In most cases the increment in urinary phosphate which resulted was consequent upon an elevated filtration of phosphate, related to the elevated GFR. A working hypothesis is offered to correlate these and other data which suggests that a tubular reabsorption-calcium mobilizing factor as well as a renal dynamic factor are present in the extract.

RADIATION EFFECTS

1155

Clinton Laboratories
THE GENERAL PICTURE OF IRRADIATION DAMAGE TO TISSUES; PART I. SUPERFICIAL RADIATION (BETA RAYS); PART II. PENETRATING RADIATIONS (NEUTRONS, GAMMA RAYS). P. S. Henshaw and R. S. Snider. July 8, 1947. Decl. July 18, 1950. 29p. (AECD-3009; MonH-288)

Part I. Radiation absorbed in the skin causes damage primarily in the germinal layer. When the damage to this layer is partial, the effect is a skin failure and repair takes place from the floor of the damaged area from living germinal cells that remain. When damage to the germinal layer is complete the effect is skin sterilization and healing must be from the edge.

Part II. The most radiosensitive tissues are of the generative type, that is, those which are continually proliferating replacement cells. In all cases (with the possible exception of lymphocytes), certain parent cells (but not necessarily the most primitive types), were found to be the most susceptible to radiation. Partial damage to a particular tissue series results in a limited period during which no mature cells are being formed. Recovery to an apparently normal condition takes place even when the acute histologic destruction has been almost complete. Subliminal damage in the case of daily exposure may hold an animal nearer to a state of exhaustion so that he is less able to cope with a crisis. When penetrating radiations are applied generally to the whole body, leukemia is the predominant tumor type obtained.

1156

Los Alamos Scientific Laboratory
THE CHANGES IN THE BLOOD OF HUMANS CHRONICALLY EXPOSED TO LOW LEVEL GAMMA RADIATION.

Norman P. Knowlton, Jr. [nd.] Decl. Dec. 21, 1948. 16p. (AECU-1021; LADC-587; LAMS-816(Rev.)(p.76-92))

A group of 10 individuals exposed to 0.2 r of γ radiation per week showed a significant fall in the total white blood count and the absolute neutrophil and lymphocyte counts during a 77-week period. The degree of fall would not have been predicted from experimental irradiation in animals, and other unknown factors might have also been casual agents. It is suggested that hematological and exposure data in other laboratories be analyzed statistically to confirm or disprove the effects of such low dosages of ionizing radiation on humans. (auth)

1157

Oak Ridge National Laboratory
PHYSICAL AND CHEMICAL FACTORS MODIFYING THE SENSITIVITY OF CELLS TO HIGH ENERGY AND ULTRAVIOLET RADIATION. Alexander Hollaender. Nov. 7, 1950. 22p. (ORNL-844)

The effect on the sensitivity of various organisms (bacteria, fungi, algae, etc.), to radiation death or chromosomal rearrangements, of exposure before or after irradiation to heat or to visible, ultraviolet, or infrared light, of water content, and of oxygen content is discussed. It may be possible to vary the number of "targets" at will, by means of adjustment of growth conditions or physical conditions during irradiation.

1158

University of Rochester Atomic Energy Project
THE INFLUENCE OF INFECTION ON THE HEMATOLOGICAL EFFECTS AND MORTALITY FOLLOWING MIDLETHAL X-RADIATION. L. R. Bennett, P. E. Rekers, and J. W. Howland. Oct. 27, 1950. 11p. (UR-140)

The careful analysis of blood cultures taken on 54 dogs following whole-body x irradiation has demonstrated the relative frequency of blood cultures of all types of organisms. Infection appears to be definitely related to mortality in those animals surviving the first 2 weeks of irradiation. This relation is less apparent in animals dying at an earlier time. No direct correlation between the definite leukopenia of dying animals and infection can be made. The presence of gram-negative organisms within the circulating blood appears to be definitely related to subsequent death of these animals. As a result of such observations preliminary experimentation has been carried out to determine the effect on morbidity and mortality of dogs and rats following various antibacterial agents. Aureomycin, streptomycin, sulfa drugs, penicillin, and terramycin have been studied extensively. Results will be reported. (auth)

1159

ACTION OF X RAYS AND CYANIDES ON FROG STRIATED MUSCLES. J. Lecomte, A. Herve, and Z. M. Bacq. Compt. rend. soc. biol. 144, 708-09(1950) May. (In French)

The authors have observed (Herve et al., Compt. rend. soc. biol. 143, 881(1949)) that an injection of NaCN or of cysteine immediately before a total x irradiation of mice reduces considerably the lethality rate due to the radiation. The question arose whether or not these substances would protect isolated striated muscles of frog against a peculiar contraction called the Lundsgaard effect, that follows an irradiation and is related to the organ's respiration disturbances; it was thought that the reducing effect of the cyanide or cysteine might inhibit the oxidizing action of x rays on enzymes. Experimental results did not confirm the hypothesis.

1160

ACTION OF X RAYS ON THE METABOLISM OF NUCLEIC ACIDS IN PROLIFERATIVE AND SECRETORY CELLS. Marina de Nicola. Experientia 6, 432-3(1950) Nov. 15. (Brief report; in Italian)

The action of x rays on the metabolism of nucleic acids in proliferative and secretory nonproliferative cells has been investigated. X rays cause a stoppage of desoxyribonucleic acid synthesis and a conversion of desoxyribonucleic acid into ribonucleic acid. All germ cells, including spermatozoa, show this effect, and the same is true for the follicular secretory cells. The germ cells are blocked at different stages of mitosis or meiosis. On the contrary, the follicular cells continue their characteristic secretory cycle, until they are entirely deprived of both nucleic acids and eventually die. The conclusion is drawn that the action of x rays is essentially specific for the nucleic acids as such, and not for some intermediate substance of their metabolism, and that stickiness, metaphasic block, and chromosome abnormalities are probably a secondary effect of this action. (auth)

1161

CAPILLARY FRAGILITY AND VITAMIN 'P' PROTECTIVE ACTION AGAINST RADIATION. Boris Sokoloff, James B. Redd, and Raymond Dutcher. Proc. Soc. Exptl. Biol. Med. 75, 6-09(1950) Oct.

Administration of leukotaxine, a bacterial polysaccharide, or an exposure to ionizing radiation induces increased capillary fragility. Injury to the capillary wall, whether it is caused by ionizing radiation, by leukotaxine, or by a bacterial polysaccharide, can be prevented to a considerable degree by the administration of a vitamin "P" compound composed of flavonoids naturally present in citrus fruit. (auth)

1162

THE COMMON CAUSES OF LYMPHOPENIA. A. J. Shillitoe. J. Clin. Path. 3, 321-31(1950) Nov.

Eighty-seven patients having lymphopenia of 1000/mm^3 or less have been tabulated with respect to the conditions with which the lymphopenia was associated. Included are an x-ray worker and a patient undergoing x-ray therapy.

1163

DISTRIBUTION OF ENZYMES IN THE LIVERS OF CONTROL AND X-IRRADIATED RATS; Stephan Ludewig and Alfred Chanutin. Arch. Biochem. 29, 441-5(1950) Dec.

The activities and percentage distributions of nonmercapto enzymes (catalase, esterase, arginase, rhodanese, and alkaline phosphatase) in rat liver homogenate and liver connective tissue are presented. The alkaline phosphatase is the only enzyme whose activity is greater in connective tissue than in liver homogenate. The activities of these

enzymes in the nuclei, mitochondria, submicroscopic particles, and supernatant fluid of liver homogenates are presented. Total-body exposure of rats to a dose of 500 r of x rays has no effect on the activity of nonmercapto enzymes. (auth)

1164

EFFECT OF BAL ON RADIATION MORTALITY RATE IN MICE. Lee Works, John H. Grotts, and Gordon W. Raleigh. Quart. Bull. Northwestern Univ. Med. School 24, 295-6 (1950) Winter.

A group of 66 mice irradiated with 550 r of 210-kvp x rays showed a 5% survival rate at the end of 5 weeks, in contrast to a 39% survival rate in a group of 61 animals of the same strain, each of which had received a subcutaneous dose of 2.6 mg of BAL (2,3-dimercaptopropanol) 1 hr prior to the irradiation. A 94% survival rate was found in mice subjected to the BAL treatment only.

1165

EFFECTS OF IONIZING RADIATIONS ON A TRANSPLANTED LYMPHOSARCOMA. Joanne Hollcroft, Egon Lorenz, and Harriet Hunstiger. J. Natl. Cancer Inst. 11, 1-16(1950) Aug.

When the effect of whole-body roentgen irradiation on a transplanted lymphosarcoma was compared with the effect of α radiation of radon and its short-lived decay products injected intravenously, little difference was noticed grossly in the regression curves. Tumor regression, i.e., the amount of tumor destroyed, was found to be dependent on the dose and was proportional to the size of the tumor at treatment. The destruction of the intramuscular lymphoma required a higher dose of roentgen irradiation than of radon (based on conversion to roentgen equivalent physical). Irradiation of the whole body was essential in causing marked tumor regression, even when the tumor alone was irradiated with more than three times the whole body dose. The systemic effect on tumor regression cannot be accounted for by any single organ as shown by irradiating various parts of the body. (auth)

1166

EFFECT OF ROENTGEN RAYS ON THE TESTIS. QUANTITATIVE HISTOLOGICAL ANALYSIS FOLLOWING WHOLE-BODY EXPOSURE OF MICE. Allen B. Eschenbrenner and Eliza Miller. Arch. Path. 50, 736-49(1950) Dec.

LAF_1 mice were exposed to 50, 100, 200, 300, and 400 r of 186-kv roentgen rays directed to the whole body at 3 months of age. The course of damage and recovery of the testes was studied. The damage and recovery pattern can be explained on the basis of a selective effect of radiation on a single stage of spermatogenesis, the spermatogonia. The course of damage and recovery following exposure to a second dose of radiation is the same as that of damage and recovery following an initial exposure. The pattern of loss and recovery of weights of the testes of mice exposed to 10-Mev roentgen rays is the same as that following exposure to 186-kv roentgen rays.

1167

EFFECT OF X-RAY IRRADIATION ON THE ALKALINE PHOSPHATASE OF THE PLASMA AND TISSUES OF RATS. Stephan Ludewig and Alfred Chanutin. Am. J. Physiol. 163, 648-54(1950) Dec. 1.

The activity of plasma alkaline phosphatase of rats was determined after single and multiple doses of x rays at varying periods after total-body irradiation. Relatively small decreases in phosphatase activity were found after exposure to 300 r. More marked and prolonged decreases were obtained after 500- and 600-r doses in both fed and fasted animals. Multiple daily radiation with small doses also causes a decrease in plasma enzyme activity. The alkaline phosphatase activity of the thymus is markedly increased during the first 2 days following irradiation. Small increases are observed in the spleen. Practically no change in enzyme activity is seen in the livers and kidneys of irradiated rats. The changes in the weights of the thymus, spleen, and liver after irradiation are presented. (auth)

1168

FIBROSARCOMA DEVELOPING IN HEAVILY IRRADIATED SKIN. Calvin B. Stewart and William J. Pendergrast. J. Med. Assoc. Georgia 40, 24-5(1951) Jan.

A case of fibrosarcoma, which developed in a scar on the lip 20 years after radium therapy for squamous carcinoma, is presented. Development of epidermoid carcinoma in radiation scar is common, whereas sarcomatous change is rare. Almost all cases reported of sarcomatous changes in irradiated tissue are associated with chronic infections or prolonged repeated irradiation. (auth)

1169

INFLUENCE OF OVARIAN FUNCTION ON INCIDENCE OF RADIATION-INDUCED OVARIAN TUMORS IN MICE. Henry S. Kaplan. J. Natl. Cancer Inst. 11, 125-32(1950) Aug.

Irradiated ovaries implanted intramuscularly into irradiated and nonirradiated groups of spayed LAF_1 hybrid mice gave rise to many granulosa-cell tumors, luteomas, and related neoplasms. No such tumors occurred when irradiated ovaries were implanted into nonirradiated, nonovariectomized mice. It is concluded that intact ovarian endocrine function inhibits the development of tumors in irradiated ovarian grafts, confirming the reported observations of Lick, Kirschbaum, and Mixer. (Cancer Research 9, 532-6(1949))

1170

Atomic Energy Research Establishment
A METHOD OF PREPARING A MODEL SHOWING SURFACE DETAIL OF THE TERMINAL PHALANX OF A FINGER. W. Graham-Smith, M. McCarthy, R. H. Brown, and T. Dyke. Nov. 1950. 8p. (AERE-Med/R-562)

Flattening of ridges, localized and generalized atrophy, atrophic fissures, and proliferative changes are cited as effects of short wavelength radiation on human finger ridge detail. Other sources indicate that repeated exposure of the hands to small doses of radiation produces recognizable changes in the finger ridges and that ridge abnormalities increase with increased years of exposure to radiation. A

rapid method of preparing durable models of the finger tips of people working with radioactive materials, as a control, is therefore described. Zeelex impressions are used for the preparation of Kallodent models. The surface form of the finger, including the nail and nail margin, is reproduced clearly and in detail.

1171

OXIDASE INCREASE IN MELANOPLUS DIFFERENTIALIS EGGS CAUSED BY X-IRRADIATION. Theodore N. Tahmisian and Dorothy M. Adamson. J. Exptl. Zool. 115, 379-97(1950) Nov.

X irradiation at 25,000 to 200,000 r has the immediate effect of lowering the oxidation of hydroquinone in diapause grasshopper eggs. Several days after x irradiation the oxidase content of the eggs increases in the following sequence: 25,000 r > 50,000 r > 100,000 r > 200,000 r > control. The oxidase is inhibited by cyanide but not by copper reagents. The oxidase is specific for hydroquinone and probably for p-phenylenediamine also, but addition of p-phenylenediamine decreases the enzymatic oxidation of hydroquinone. This is probably due to an imine formation. The −SH groups in the embryo are not oxidized immediately after x irradiation. Eighteen days after x irradiation almost all the −SH groups are oxidized. (auth)

1172

PHYSICAL AND BIOLOGICAL PHENOMENA PRODUCED BY IRRADIATIONS WITH FAST ELECTRONS. W. Paul and G. Schubert. Naturwissenschaften 37, 156-63(1950) Apr. (In German)

A systematic comparative study of the action of hard x rays (200 kv) and of fast electrons (from a 6-Mev betatron) is being made at the authors' laboratory in Göttingen, Germany. In a general survey of the work done, quantitative differences in the absorption of the two radiations by matter, specific qualitative aspects of their biological action, and the present-day outlook for therapeutic application of fast electrons are examined. 11 figures.

1173

PROTECTIVE ACTION OF ANOXIC ANOXIA AGAINST TOTAL-BODY ROENTGEN IRRADIATION OF MAMMALS. Andrew H. Dowdy, L. R. Bennett, and Sarah M. Chastian. Radiology 55, 879-85(1950) Dec.

The effects of brief extreme anoxic anoxia on the LD_{50} and on the radiation syndrome observed in mammals after total-body roentgen irradiation has been investigated. The 30-day LD_{50} for rats irradiated in 5% oxygen appears to be between 1200 and 1400 r as contrasted with an LD_{50} of slightly higher than 600 r in irradiated control rats. Anoxia produced by injection of NaCN failed to protect rats from roentgen irradiation. These experiments support the theory that radiochemical reactions involving free oxygen play a vital role in radiation injuries. (auth)

1174

PROTECTIVE ACTION OF KCN AGAINST MORTALITY IN MICE IRRADIATED WITH VARIOUS DOSES OF X RAYS. H. Betz and A. Herve. Compt. rend. soc. biol. 144, 1015-17(1950) July. (In French)

Experiments have been performed to determine whether the protective action of KCN injected prior to irradiation with the minimal x-ray dose (700 r) persists at higher exposures. Six control lots of 30 to 40 C57 adult mice were irradiated with 500, 700, 900, 1200, 1800, and 3000 r of 250-kv x rays. Five identical lots were irradiated with the same doses (except 3000 r) following intraperitoneal injection of 0.05 mg of KCN. The 500-r exposure caused no mortality in either control or injected mice; at 700 r the KCN reduced the death rate from 100% at 10 days to 75%; and at 900 r 22% of the injected mice survived. The mortality curves of control and injected mice were very similar at 1200 r, the KCN prolonging the lives of a few animals by only 2 days, and were identical at the 1800-r irradiation. The mechanism of radiation damage causing this reduced effectiveness is discussed.

1175

PYRIDOXINE AND EXPERIMENTAL X-RADIATION INJURY IN RATS. M. L. MacFarland, M. V. Peters, R. M. Ballantyne, and E. W. McHenry. Am. J. Physiol. 163, 394-9(1950) Nov. 1.

To investigate a possible relation between pyridoxine insufficiency and x-ray injury, the effects of total-body irradiation on pyridoxine-deficient rats and on animals receiving this factor were compared. Pyridoxine deprivation was not found to increase the susceptibility of rats to x-ray damage, and irradiation did not affect the concentration of total vitamin B_6 in the livers of either deficient or control animals. (auth)

1176

RADIATION-INDUCED SQUAMOUS-CELL METAPLASIA AND HYPERPLASIA OF THE NORMAL MUCOUS GLANDS OF THE ORAL CAVITY. Milton Friedman and John W. Hall. Radiology 55, 848-51(1950) Dec.

Irradiation of the normal mucous glands of the oral cavity incidental to radiotherapy for squamous-cell carcinoma of the mouth and oropharynx, in a series of 64 cases, frequently produced squamous metaplasia of the glandular epithelium. This metaplastic change, probably involving the cells of the basal layer of the ducts and acini, varied considerably in degree and time of onset.

1177

A STUDY OF ELASTIC ARTERIES IN IRRADIATED MICE OF DIFFERENT AGES. Christianna Smith and Lois A. Loewenthal. Proc. Soc. Exptl. Biol. Med. 75, 859-61(1950) Dec.

Changes comparable to those of physiological aging were induced by x radiation in the tunica media of elastic arteries of mice of different ages. In the elastic arteries of 20-to-30-day- and 80-to-100-day-old irradiated mice there were increased amounts of ground substance, increased numbers of interlamellar fibers, and premature raggedness and fraying of the elastic membranes. No changes attributable to irradiation were seen in the arteries of the old mice. (auth)

1178

SULFHYDRYL-CONTAINING AGENTS AND THE EFFECTS OF IONIZING RADIATIONS. I. BENEFICIAL EFFECT OF

GLUTATHIONE INJECTION ON X-RAY-INDUCED MORTALITY RATE AND WEIGHT LOSS IN MICE. W. H. Chapman, C. R. Sipe, D. C. Eltzholtz, E. P. Cronkite, and F. W. Chambers, Jr. Radiology 55, 865-73(1950) Dec.

Male and female mice were exposed to total-body x-ray irradiation, in doses of 800 r. Four hundred were given glutathione before or both before and after irradiation. Two hundred were given control saline injections, and 200 received no treatment. The survival rates of the glutathione-treated groups were greater (63.8%) than the survival rates for the comparable control groups (40 to 46%). Statistical analysis showed that the differences in survival rates were definitely significant. The surviving glutathione-treated irradiated animals lost less weight and recovered weight more rapidly than the surviving irradiated control animals. Glutathione-treated survivors, when traumatized, had a lower mortality than the nontreated controls. (auth)

1179

VARIATIONS OF LISTERIA MONOCYTOGENES PRODUCED BY BETA PARTICLES FROM RADIOPHOSPHORUS. Matthew C. Hunter, Grant L. Stahly, and Wm. G. Myers. Ohio J. Sci. 50, 253-9(1950) Nov.

Cells of Listeria monocytogenes bacteria were suspended in a medium containing radioactive phosphorus at a total radiation level of approximately 45,000 equiv. r over an 11-day period. At 24-hr intervals samples were removed and streaked on suitable media. Nineteen strains were isolated which showed variations from the parent in their colonial characteristics. Some of these also showed variations in physiological characteristics, in their antigenicity, and in their capacity to produce disease.

1180

VARIATIONS IN THE MINIMUM ENDOGENEOUS NITROGEN EXCRETION AS AN EFFECT OF TOTAL-BODY X-IRRADIATION. Charles Gros and Paul Mandel. Compt. rend. 231, 631-3(1950) Sept. 25. (In French)

After rats on a protein-free diet had reached the minimum of their endogeneous nitrogen excretion, they were irradiated with 400 r of 190-kv x rays. Determinations of the total-nitrogen, allantoin, and creatinine excretions before and 6 or more days after irradiation showed an average increase in the total endogeneous excretion of 36% with a maximum of 56%. The excretion of allantoin, which is remarkably constant normally, increased by 44% on the average and 62% in the limiting case. In contrast, no variation was found in creatinine elimination. Several possible interpretations of these results are discussed briefly.

RADIATION HAZARDS AND EFFECTS

1181

University of Rochester Atomic Energy Project
OSCILLATING THERMAL PRECIPITATOR. Sidney Laskin. July 24, 1950. 28p. (UR-126)

An instrument is described for precipitating aerosols which utilizes the principle that particles in an air stream drawn past a hot wire will collect on nearby cool surfaces. In order to avoid difficulties in counting caused by size segregation, the sample collector is oscillated to achieve random distribution of the particles. The apparatus is illustrated, and electron micrographs of representative fumes and mists are shown. 13 figures.

1182

MEDICAL ASPECTS OF ATOMIC EXPLOSION. Heinz Richard Landmann. J. Kansas Med. Soc. 51, 557-62(1950) Dec.

A brief, general review of the medical problems associated with an atomic explosion is presented.

1183

NUCLEAR FISSION OPERATIONS AND THE WASTE TREATMENT PLANT OPERATOR. George A. Rhame. Sewage and Ind. Wastes 22, 1494-7(1950) Nov.

An elementary treatment of the problem of waste disposal in nuclear fission plants is presented.

1184

THE PROTECTION OF PERSONNEL ENGAGED IN ROENTGENOLOGY AND RADIOLOGY. FINAL REPORT. F. T. Hunter and L. L. Robbins. New Engl. J. Med. 244, 9-13(1951) Jan. 4.

Film-badge monitoring has led to lowered radiation exposure because personnel become more cautious and flaws in technique and protection are discovered. The personnel covered in this study are now receiving an average weekly exposure less than one-tenth the so-called "permissible" exposure. Variations in the leukocyte count and in the polynuclear and eosinophil percentages showed no statistical evidence of being related to the average weekly exposure, nor to the number of years the worker had engaged in roentgenology.

1185

Chemical Corps School, Army Chemical Center
RADIOLOGICAL DEFENSE OFFICERS COURSE; LABORATORY MANUAL. Oct. 1, 1949. 75p. (NP-1914; Cml C School Mimeo No. 398)

The basic purpose of the Radiological Defense Course is to train personnel in the operational problems of radiological defense so that they are able to direct the protection of personnel when radiological hazards exist, and so they can advise their commanding officers on matters pertaining to atomic warfare and the accompanying hazards. Sections on the following are presented: introduction to laboratory exercises; calibration of pocket chambers, minometers, and exposing of film badges for laboratory calibration; calibration of G-M type survey meters; introduction to laboratory counting and determination of G-M plateau; determination of shielding properties of common materials; calibration of ion chamber instruments; calibration of film badges; determination of resolving time of a G-M tube; determination of absorption coefficients by use of the scaler; field maintenance of instruments; recalibration of G-M type survey meters; practical field survey; determination of the mass of a point source of radium; and determination of an unknown isotope.

1186

SOME ASPECTS OF ATOMIC MEDICINE. J. M. Holford. Proc. Roy. Soc. Med. 43, 851-7(1950) Nov.

Part of the duties of service medical officers is to form a considered judgment of the various hazards to which service personnel are likely to be exposed. This paper draws attention to some of the factors which are relevant to this task in connection with the atomic bomb. A discussion of work on the irradiation of aqueous solutions, morphological changes in cells, the clinical picture of acute radiation illness in man, fractionation of dose, genetic changes, general effects of radiation on mammalian testes, etc. is presented.

RADIOGRAPHY

1187

DETECTION OF RADIO-ELEMENTS IN HISTOLOGICAL SLIDES BY COATING WITH STRIPPING EMULSION — THE "STRIP-COATING" TECHNIC. Rita Bogoroch. Stain Technol. 26, 43-50(1951) Jan.

The "strip-coating" technique offers some improvement over the published methods for the autographic detection of radioelements in sections by stripping films. Reproducible results are easily obtained with Ilford Half Tone Stripping Plate Emulsion. The method does not lend itself readily to the preparation of the large number of slides usually required for biological research. (auth)

1188

SINGLE CELL AUTOGRAPHS OF BONE MARROW AND BLOOD FROM RATS USING RADIOACTIVE PHOSPHORUS. William I. Morse II. Am. J. Med. Sci. 220, 522-9(1950) Nov.

Single-cell autographs of marrow and peripheral blood elements, following the injection of P^{32} in rats, are reported for the first time. In the small number of satisfactory preparations studied, the youngest erythropoietic and granulopoietic forms from the marrow have the most intense autographs, indicating rapid phosphorus turnover. Autographs of megakaryocytes and lymphocytes are faint at best. If the observation of more selective uptake by marrow elements than occurs in the lymphatic system is substantiated, it would suggest that radioactive phosphorus has some advantages over roentgen-ray therapy in myelogenous leukemia. The technique at present has many limitations. Desirable improvements and some applications to hematological problems are discussed. (auth)

1189

STAINING OF RADIOAUTOGRAPHS WITH METANIL YELLOW AND IRON HEMATOXYLIN. Eva B. Simmel, Patrick J. Fitzgerald, and John T. Godwin. Stain Technol. 26, 25-8(1951) Jan.

A staining procedure is presented for radioautographs prepared by mounting tissue sections directly on photographic emulsions. Heavy and uneven absorption of stains by the emulsion gelatin precludes the use of routine hematoxylin and eosin methods. Metanil yellow and iron hematoxylin have been employed and found to give uniformly satisfactory results.

RADIOTHERAPY

1190

THE BIOLOGICAL HALF-LIFE OF RADIOACTIVE PHOSPHORUS IN THE BLOOD OF PATIENTS WITH LEUKEMIA. I. WHOLE BLOOD; WITH DEVIATIONS OF OBSERVATIONS FROM PREDICTED VALUES AND AN ESTIMATE OF TOTAL-PHOSPHORUS TURNOVER RATE. Harold Tivey and Edwin E. Osgood. Cancer 3, 992-1002(1950) Nov.

The rate of disappearance of radiophosphorus from the blood of 29 patients with leukemia has been studied, and it has been found that the logarithm of the concentration of P^{32} decreases uniformly with time over the period from 1 to at least 40 days. The most probable value for the biological half-life of P^{32} in whole blood for the group of patients included in this study is approximately 8 days (95% confidence limits: less than ±1 day). The most probable value of the calculated initial zero-time concentration of P^{32} in $\mu c/ml$ whole blood is approximately 53% of the injected P^{32} in $\mu c/g$ of body weight. An analysis of individual biological half-lives shows that this quantity will vary among individuals from approximately 5 to 11 days, but that associated with this is a compensating variation in the calculated zero-time level, so that the amount of radiation delivered by the intrinsic P^{32} in a tissue showing radiophosphorus-disappearance curves similar to those of this study will vary by not more than about 25% from one extreme of this range to the other. Approximately 19 days (±1 day) are required for the disappearance of half of the phosphorus atoms in the blood of the average patient of this series; the apparent average life of a phosphorus atom in the whole blood of this series of leukemia patients is 27 days (±1 day).

1191

THE BIOLOGICAL HALF-LIFE OF RADIOACTIVE PHOSPHORUS IN THE BLOOD OF PATIENTS WITH LEUKEMIA. II. PLASMA; WITH DEVIATIONS OF OBSERVATIONS FROM PREDICTED VALUES AND AN ESTIMATE OF TOTAL-PHOSPHORUS TURNOVER RATE. Edwin E. Osgood and Harold Tivey. Cancer 3, 1003-09(1950) Nov.

The plasma-P^{32} levels of 26 patients with leukemia have been studied. The logarithm of the radioactivity of the plasma decreases uniformly with time after the first 3 days, with a biological half-life of 8.5 days. The theoretical zero-time level of this curve represents, in $\mu c/ml$, 16% of the injected P^{32} in $\mu c/g$ of body weight. There is no significant difference in the data between patients with lymphocytic and granulocytic leukemias over the 3- to 42-day period studied. For this group of clinically controlled patients, the curve for the disappearance of P^{32} from the plasma is essentially parallel to the curve for the disappearance of P^{32} from the whole blood, and the absolute levels of these curves are related in approximately the ratios of the total inactive phosphorus content of plasma

and blood, respectively. Corrected for the decay of P^{32} in the blood of the patient, these data indicate that the nonradioactive phosphorus compounds, as a group, enter and leave the plasma at such a rate that half the phosphorus present at any one time will have been replaced in approximately 21 days.

1192

THE BIOLOGICAL HALF-LIFE OF RADIOACTIVE PHOSPHORUS IN THE BLOOD OF PATIENTS WITH LEUKEMIA. III. ERYTHROCYTES; WITH DEVIATIONS OF OBSERVATIONS FROM PREDICTED VALUES. Harold Tivey and Edwin E. Osgood. Cancer 3, 1010-13(1950) Nov.

Radioactive phosphorus levels were determined in the erythrocyte and plasma fractions of 151 blood samples divided among 13 patients with lymphocytic leukemia and 14 patients with granulocytic leukemia. No significant differences were found between the erythrocyte levels of P^{32} of these two groups, or between the ratios of erythrocyte to plasma P^{32} per unit volume, over the period from 3 to 42 days covered by this study. It is shown that the logarithm of the level of P^{32} in the erythrocyte fraction of the blood of leukemia patients, from approximately 3 to 42 days after injection of P^{32}, may be represented as a linear function of time. The theoretical zero-time level of P^{32} represented by extrapolation of this curve is 92% of that predicted by the uniform distribution of the injected phosphorus throughout the body of the patient. The slope of this curve is such that 50% of the initial level is reached in 8.9 days. It is considered that there was no essential difference in the slopes of the curves for the disappearance of P^{32} from the erythrocytes and from the plasma of these patients, and hence an approximate equilibrium between total-plasma and erythrocyte P^{32} exists after the first 72 hr. (auth)

1193

THE BIOLOGICAL HALF-LIFE OF RADIOACTIVE PHOSPHORUS IN THE BLOOD OF PATIENTS WITH LEUKEMIA. IV. LEUKOCYTES; RADIOACTIVE PHOSPHORUS CONTENT AND THE RELATION TO PLASMA-P^{32} LEVELS. Edwin E. Osgood and Harold Tivey. Cancer 3, 1014-17 (1950) Nov.

The results of 55 determinations of the P^{32} content of granulocytes and 61 similar determinations of the P^{32} content of lymphocytes from patients with leukemia, treated with radioactive phosphorus, are presented graphically. Total P^{32} content per ml of cells 7 days after injection, expressed as a fraction of the preceding dose of radioactive phosphorus, was studied with the findings: (1) Total P^{32} content is approximately parallel to the mean plasma-P^{32} level for this group of patients. (2) Individual total-P^{32} levels vary remarkably between approximately 10 and 50 times the P^{32} concentration in the same volume of plasma. (3) The data presented show no clear-cut differentiation between the P^{32} content of lymphocytes and granulocytes per unit volume. (4) The partition of radioactive phosphorus is approximately proportional to the ratios of total phosphorus per unit volume of plasma and granulocytes. (5) The partition of radioactive phosphorus between plasma and lymphocytes is not in proportion to their total phosphorus content; significantly less P^{32} was found than predicted on this basis. The reasons for this are briefly mentioned. As a clinical approximation, the P^{32} content of leukemic leukocytes may be estimated after 1 week as approximately 30 times the P^{32} content of a similar volume of the plasma of the same patient. (auth)

1194

THE CLINICAL USE OF RADIOACTIVE ISOTOPES. Bertram V. A. Low-Beer. Springfield, Ill., Charles C. Thomas, 1950. 414p.

The first part of this book is intended to acquaint physicians and medical students with the principles of artificial radioactivity and its uses in clinical medicine. Written for the intelligent layman, the various chapters on atomic and nuclear physics and the detection, standards, and hazards of radioactivity present complex physical processes in a graphic manner. The second part deals with the use of radioisotopes in clinical investigations and radiotherapy. 327 references.

1195

A CONSTANT REGISTRY AUTORADIOGRAPHIC TECHNIC. Dan H. Buie, Jr., Frank E. Hoecker, and Paul G. Roofe. Proc. Soc. Exptl. Biol. Med. 75, 747-9(1950) Dec.

In order to study the distribution and concentration of radioisotopes metabolically deposited in bone, it is necessary that certain very definite requirements be fulfilled by the autoradiographic technique. (1) It must permit the bone sections to be removed from the nuclear-track emulsion during photographic processing and thus prevent the bone section from coming into contact with the processing solutions. (2) It must permit the bome sections to be removed from the nuclear-track emulsion during the making of photomicrographs of the α-particle track pattern. (3) It must permit the bone sections to be returned exactly to their original positions on the nuclear track plate at any desired time. An apparatus and technique for attaining these requirements is described, and step-by-step operating procedures are given.

1196

DIAGNOSTIC AND THERAPEUTIC USE OF RADIOACTIVE IODINE. Dwight E. Clark, Otto H. Trippel, and Glenn E. Sheline. Arch. Internal Med. 87, 17-24(1951) Jan.

The use of radioactive iodine in the diagnosis of thyroid states and in the treatment of both hyperthyroidism and carcinoma of the thyroid is discussed. It is concluded that more knowledge regarding the long-term effects of radiation from I^{131} on the tissues of the body must be gained before its place in the diagnosis and treatment of diseases of the thyroid is finally established. From experience to date, this isotope seems valuable in the diagnosis of various thyroid states, in the treatment of selected patients with hyperthyroidism, and in the treatment of certain types of carcinoma of the thyroid.

1197

INFLUENCE OF ESTRADIOL ON P^{32} UPTAKE BY THE UTERUS. Robert C. Grauer, Herbert S. Strickler, Jerome J. Wolken, and Eugene Cutuly. Proc. Soc. Exptl. Biol. Med. 75, 651-4(1950) Dec.

The preferential localization of radioactive phosphorus is enhanced in the uterus of the immature rat by the adminis-

tration of estradiol. P^{32} becomes bound in the estradiol-primed uterus as evidenced by the increase of P^{32} in the acid-insoluble fraction. The liver is not influenced in this process, indicating that the proliferating cells in a hormone-treated target organ influence the uptake of P^{32}. The data indicate a suggested approach to the treatment of genital malignancies. (auth)

1198

LYMPHADENOSIS CUTIS CIRCUMSCRIPTA TREATED WITH RADIOACTIVE PHOSPHORUS. Seth S. Barnes and Thomas W. Moffatt. Arch. Dermatol. Syphilol. 62, 556-61 (1950) Oct.

A case is reported in which a solitary nodular skin plaque developed on the bridge of the nose of a 52-yr-old housewife with chronic lymphogenous leukemia. Biopsy findings were consistent with the clinical diagnosis of lymphadenosis cutis circumscripta. Though treatment with radioactive phosphorus effected an excellent clinical improvement in the patient, the lymphadenosis cutis circumscripta failed to regress after the injection of P^{32}. On the contrary, there was a measurable increase in the size and number of the individual papules forming the plaque. (auth)

1199

THE 1950 YEAR BOOK OF RADIOLOGY. PART I. RADIOLOGIC DIAGNOSIS. Fred Jenner Hodges and John Floyd Holt, eds. PART II. RADIATION THERAPY. Isadore Lampe and Robert S. Mac Intyre, eds. Chicago, The Year Book Publishers, Inc., 1950. 1 vol., 480p.

Part II of this volume reviews in detail the developments during the year of June 1949 to June 1950 in the fields of radiation physics, radiotherapy techniques, radiobiology, hazards and protection, clinical considerations, and radiation therapy of the various organs or body areas.

1200

ON THE POSSIBLE APPLICATION OF ISOTOPES TO THE MANAGEMENT OF CANCER. Simeon T. Cantril. Ann. Internal Med. 33, 1450-8(1950) Dec.

The present very limited applicability of radioisotopes to all but a few rare types of cancers is stressed in this general discussion of the problems, difficulties, and dangers of isotope therapy.

1201

RADIO-ACTIVE IODINE AND THYROID DISEASES IN SOUTH AFRICA. S. African Med. J. 24, 1037-40(1950) Dec. 16. (Editorial)

An editorial discussing briefly the indications and contraindications of radioiodine therapy, and the problems peculiar to South Africa in the use of this isotope is presented.

1202

RADIOACTIVE IODINE IN THE TREATMENT OF HYPERTHYROIDISM. E. Perry McCullagh and Charles E. Richards. Arch. Internal Med. 87, 4-16(1951) Jan.

The results of I^{131} treatment in 203 patients having diffuse goiters and hyperthyroidism and in 78 patients having nodular goiters and hyperthyroidism are presented. The great difference in total dosage requirement for remission between most patients is pointed out.

1203

RESEARCHES ON THE RADIOTHERAPY OF ORAL CANCER. Constance A. P. Wood and J. W. Boag. Medical Research Council Special Report Series No. 267. London, His Majesty's Stationery Office, 1950. 148p.

The first part of this report compares the clinical results of treating cancer of the mouth and throat by x rays and by radium γ beam, respectively. Included here is also an account of new methods of dosage measurement, and of their use in planning treatment. The second part deals with the response of malignant tissues to irradiation, and is an account of histological work carried out at the Strangeways Research Laboratory, Cambridge, in collaboration with the Radiotherapeutic Research Unit. A third section presents a statistical analysis of the response to treatment of 641 patients suffering from cancer of the mouth and throat. In this section an analysis is also made of certain factors in the clinical history and physical signs of the disease. A statistical method of estimating the final results of a clinical experiment, before long-term survival figures become available is described, and this method is used to compare the results of x-ray and radium-beam treatment. Finally, conclusions are drawn about the most fruitful lines of development in radiotherapy in the immediate future, and some suggestions are put forward for further experimental work. These include electron-beam, neutron-beam, and radioisotope therapy.

1204

THERAPY WITH RADIOACTIVE ISOTOPES, ESPECIALLY IN POLYCYTHEMIA. Jan Waldenström. Berlin. med. Z., 222-4(1950) Mar. 15. (In German)

The only encouraging results in the present-day therapeutic use of radioisotopes are probably those obtained with P^{32} in the cure of polycythemia. It is concluded from 17 cases treated (2 to 3.5 mc injected intravenously once or twice) that, barring possible complications, this is the best known therapy of the disease.

TOXICOLOGY STUDIES

1205

University of California Atomic Energy Project, Los Angeles
A STUDY OF THE ACUTE AND CHRONIC TOXICITY OF TOLUIDINE BLUE AND RELATED PHENAZINE AND THIAZINE DYES. Thomas J. Haley and Frances Stolarsky. Nov. 30, 1950. 13p. (UCLA-100)

A study has been made of the acute and chronic toxicity of Toluidine Blue, Azure A, Thionine, Neutral Red, Neutral Violet, Safranine, and Janus Green. LD_{50} values for the mouse, rat, and rabbit are reported. Upon an acute toxic basis the dyes were rated in the order of increasing toxcity as follows: Neutral Red, Azure A, Neutral Violet, Toluidine Blue, Safranine, Janus Green, and Thionine. The relationship between chemical structure and toxicity has been dis-

cussed. None of the dyes except Neutral Red produced any detectable pathological changes when administered twice weekly for a period of 90 days. Further investigation of the possible chronic effects of Neutral Red are to be undertaken, because the results of the present investigation were equivocal. (auth)

1206

BIOCHEMICAL CHANGES IN ACUTE BERYLLIUM POISONING. W. N. Aldridge, J. M. Barnes, and F. A. Denz. Brit. J. Exptl. Path. 31, 473-84(1950) Aug.

Some of the biochemical disturbances associated with acute beryllium poisoning in rabbits and rats have been examined. In rabbits there is a progressive fall in the blood-sugar levels until hypoglycemic convulsions develop just before death. At an earlier stage there is an impairment in the rate of removal of injected glucose and lactate from the blood. Blood-calcium levels and blood-urea and nonprotein-nitrogen levels are not seriously affected. The serum alkaline phosphatase rises with increasing bilirubinemia. The liver phosphatase also rises. On the other hand, the liver potassium and liver arginase levels fall progressively. The results are discussed and it is concluded that the biochemical disturbances demonstrated are the result of progressive destruction of the liver tissue. (auth)

1207

DISTRIBUTION OF PARENTERALLY ADMINISTERED LITHIUM IN PLASMA, BRAIN, AND MUSCLE OF RATS. Virginia D. Davenport. Am. J. Physiol. 163, 633-41(1950) Dec. 1.

The intraperitoneal or oral administration of LiCl to rats in doses of 1.0 millimole/kg or greater resulted in diarrhea which could be prevented by atropine. Following the intraperitoneal administration of 6 millimoles of LiCl/kg, the cerebral excitability of rats, as measured by the electroshock seizure threshold, was increased for at least 24 hr. The increased excitability appears to have been caused in part by the loss of plasma Na and in part by the presence of low concentrations of Li in the central nervous system. Rats treated chronically with 0.6 millimoles LiCl/kg/day showed a loss of appetite in the 1st and again in the 5th and 6th weeks. They had lower seizure thresholds than did pair-fed controls and, when sacrificed at the end of 6 weeks, lower plasma Na concentrations. Although the situation was complicated by restricted food intake, the increased cerebral excitability again appears to be related to the loss of plasma Na combined with the presence of Li in the central nervous system. Calculations of the intra- and extracellular distribution of Li show that it passes more slowly into and out of cerebral tissue than muscle tissue. There was no indication of accumulation of Li in either tissue. (auth)

1208

EXPERIMENTAL BERYLLIUM GRANULOMAS OF THE SKIN. Frank R. Dutra. Arch. Ind. Hyg. Occupational Med. 3, 81-9(1951) Jan.

Beryllium granulomas have occurred in the skin and subcutaneous tissues of pigs after implantation of phosphor powders which contain BeO. Nonspecific granulomas of foreign-body type occurred in the tissues into which metallic Be or BeO alone had been implanted. Two different samples of powdered BeO, one of which was calcined at a relatively low temperature for a relatively short time as contrasted with the second, produced tissue reactions that differed greatly. The more extensive and protracted reaction was produced by the powder which had been calcined least.

1209

TOXICOLOGICAL AND METABOLIC EFFECTS OF FLUORINE-CONTAINING COMPOUNDS. Joseph Larner. Ind. Med. Surg. 19, 535-9(1950) Nov.

The various aspects of the problem of fluoride toxicity are discussed, and the ubiquitous distribution of this element is pointed out. The acute and chronic toxicity and the important mechanisms of this toxicity are reviewed. 103 references.

1210

ON THE PHARMACOLOGY OF CERIUM. Fr. Meyer. Arch. exp. Path. Pharmakol. 210, 247-56(1950) June. (In German)

The absence of a definite opinion on the action of Ce on the blood constituents is due to the small number of animals observed so far. An extensive series of experiments on guinea pigs (average daily dose 6 mg of Ce^{+3} ion subcutaneously for 22 days) showed that both in normal and in anemic animals Ce salts do not appreciably affect either the blood picture or the growth. These negative results are probably related to the low toxicity of Ce.

TRACER APPLICATIONS

1211

Brookhaven National Laboratory
THE UPTAKE OF LANTHANUM BY A YEAST. V. T. Bowen and Ann Carbone. [nd.] 6p. (AECU-1073)

Preliminary experiments indicate that yeasts growing in a medium containing Ba^{140}-La^{140} equilibrium mixture preferentially absorb the lanthanum.

1212

Sloan-Kettering Institute for Cancer Research
THE ZONE OF LOCALIZATION OF ANTIBODIES; XI. THE IN VIVO PURIFICATION OF KIDNEY-LOCALIZING ANTIKIDNEY ANTIBODY. David Pressman and Bella Sherman. [nd.] 15p. (AECU-1106)

Purification, in vivo, of the kidney-localizing antibody from radioiodinated anti-mouse-kidney serum has been accomplished by injecting the antiserum into mice, eluting the localized radioantibody from the perfused kidneys of these animals with alkali, and injecting the solution of recovered radioantibody into recipient animals. About 8% of the radioactivity thus injected localized in the kidneys, whereas only 0.5 to 1% localizes from radioantiserum not specifically purified. Localization was rapid, and the ratio of radioactivity in tissue to that in blood was about 4 within 3 hr. The possible application of this procedure to the investigation of active glomerulonephritis is discussed. 16 references. (auth)

1213

STUDIES ON THE RELATIONSHIP BETWEEN VIRUS AND HOST CELL: THE PREPARATION OF T2r$^+$ BACTERIOPHAGE LABELLED WITH RADIOACTIVE PHOSPHORUS. S. M. Lesley, R. C. French, and A. F. Graham. Can. J. Research 28E, 281-8(1950) Dec.

T2r$^+$ bacteriophage grown in its host, Escherichia coli B, in broth medium in the presence of radioactive inorganic phosphorus became labeled with the isotope. Purified suspensions of this virus had specific activities up to 50,000 cpm/μg of P. There was little or no exchange of P^{32} between virus and inorganic phosphate. Chemical analysis showed that at least 98% of the virus phosphorus was contained in nucleic acid; of the nucleic acid phosphorus 95.5% was associated with desoxypentose nucleic acid and 4.5% with pentose nucleic acid. More than 99% of the radioactivity of the labeled bacteriophage was contained in the nucleic acid fraction. Preparations of bacteriophage were obtained with sufficiently high specific activity to enable metabolism experiments to be carried out on the growth of the labeled virus in the host cell. 13 references. (auth)

CHEMISTRY

1214

COAGULATION ISOTHERM OF THORIUM. J. D. Kurbatov and A. M. Silverstein. J. Phys. & Colloid Chem. 54, 1250-2 (1950) Nov.

In order to establish the continuity of the process of coagulation of visible quantities of tetravalent thorium and their removal from solution by filtration with the removal of invisible quantities of the same element from solution under the same experimental conditions, a coagulation isotherm of thorium has been obtained, using quantities from 1×10^{-5} to 1×10^{-9} gram-atom. The coagulation isotherm obtained under these conditions shows that there is no discontinuity in the removal of thorium on filter paper in the concentrations used. While the highest concentration was conventional and the lowest was 5×10^{-8}M, the process of removal of thorium from solution at pH 3.5 is not conceded as identical with the precipitation of hydrous oxides. The process consists in (1) adjustment of the pH of the solution to that of hydrolytic coagulation and (2) filtration. For the latter step the action of the filter paper is similar to the action of adsorbents.

1215

ISOTOPE EXCHANGE OF HYDROGEN IN HYDROGEN-SILICON BONDS. A. I. Brodskiĭ and I. G. Khaskin. Doklady Akad. Nauk S.S.S.R. 74, 299-301(1950) Sept. 11. (In Russian)

It is known that in groups C−H hydrogen-isotope exchanges are very slow, if not altogether absent. One of the co-authors (Brodskiĭ, Izvest. Akad. Nauk S.S.S.R., Otdel. Khim, Nauk, No. 1, 3(1949)) explained this by the absence in the foregoing carbon atom of free electron pairs which would ensure the addition of D before the bond C−H was severed. Observations on analogous bonds H−H and B−H, reported in literature, confirm these views. Since the same structural situation exists in Si−H, a similar quasi-absence of hydrogen-isotope exchanges is to be expected. This was established in a series of equilibrium experiments between D_2O (or C_2H_5OD) and $HSi(C_2H_5)_3$, $HSi(C_6H_5)_3$, and $HSi(OC_2H_5)_3$ under various conditions and in the presence or absence of catalysts.

1216

SLOW HYDROGEN EXCHANGES IN SOLUTIONS OF AMMONIUM SALTS. A. I. Brodskiĭ and L. V. Sulima. Doklady Akad. Nauk S.S.S.R. 74, 513-15(1950) Sept. 21. (In Russian)

No distinction is usually made between NH_3 and NH_4 in their readiness to undergo H/D exchanges; the practically instantaneous exchange in NH_3 is extended to the case of the ion. However, in accordance with one of the co-author's views (Brodskiĭ, Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, No. 1, 3(1949); NSA 3-675), exchanges in ammonium should proceed very slowly, because N there lacks free electron pairs that would allow a direct addition of D prior to breaking of the bond N−H. An analogous situation is the cause of the known quasi-absence of exchanges in the group C−H, and of the recently found similar effect in Si−H of silane derivatives (Brodskiĭ et al., Doklady Akad. Nauk S.S.S.R. 74, No. 2(1950)). From this point of view, fast exchanges actually observed in NH_4 should be explained as due to a previous hydrolysis $NH_4 + H_2O \rightarrow NH_3 + H_3O^+$, followed by isotope exchanges in NH_3. Consequently, in the presence of strong acids which depress the hydrolysis, exchanges should be essentially slowed down. This was confirmed in a series of experiments involving NH_4NO_3, D_2O, HNO_3, and H_2SO_4. In order to avoid the dilution with ordinary hydrogen, concomitant with the usual precipitation procedures, samples of the reaction product for analysis were precipitated with acetone (fastest), or dioxane, or by freezing out.

1217

SOME PROPERTIES OF THORIUM IN VERY DILUTE AQUEOUS SOLUTIONS. M. H. Kurbatov, Harriet B. Webster, and J. D. Kurbatov. J. Phys. & Colloid Chem. 54, 1239-50(1950) Nov.

The coagulation of thorium from 10^{-4}M solution at different pH values and variable concentrations of foreign ions is similar to the removal, by filtration, of invisible quantities of $UX_1(Th^{234})$ in concentrations of 10^{-13}M. At constant time intervals with carbonate content minimized, increase in OH^- increases the removal of UX_1 present in trace amounts. The plot of pH versus fraction of UX_1 removed from solution gives an experimentally straight line between pH 1 and 4.5. This is consistent with similar results on solutions containing 10^{-8} gram-atom of thorium and on the formation of radiocolloids of yttrium and zirconium. Change in nitrate ion in solution with other factors comparable was shown to result in increased removal of UX_1 with decreased nitrate-ion concentration in the absence of

carbonate ions. The effect of change of bicarbonate-ion content in solutions of UX_1 was shown to be very great and in opposite direction to the effect of hydroxyl ion. It was pointed out that this effect may be attributed to complex ion formation along with interference of both the monovalent bicarbonate ion and the divalent carbonate ion with the radiocolloid formation. With uranium concentrations of 0.0004M or less (and other conditions as described) as much as 60% of the UX_1 present in trace amounts can be removed by filtration. In conclusion, UX_1 in quantities of the order of 10^{-15} gram-ion shows regularities in radiocolloid properties, but its behavior is highly sensitive not only to small amounts but to moderate variations in the quantity of carbonate present in solution. (auth)

ANALYTICAL PROCEDURES

1218

M.I.T. Mineral Engineering Laboratory
NEW FLUORIMETERS FOR THE DETERMINATION OF URANIUM; MIT MODELS I, II, III, AND IV. David Kaufman, Mario Castillo, and Urpo Koskela. July 1, 1950. 32p. (MITG-A-70) UNCLASSIFIED

Four new fluorimeters for the determination of uranium have been designed and constructed at the MIT Mineral Engineering Laboratory. These fluorimeters have followed the basic optical arrangement and have used the same light-detecting system as that used in the Argonne Model XI fluorimeter, but the construction of the instruments has been simplified and the sensitivity increased 2 to 6 fold. Detailed drawings are given for MIT Model III. The Argonne fluorimeter was modified by the substitution of an AH6 lamp for the AH4 lamp previously used. The sensitivity was increased by a factor of 12. Water cooling of the fluorimeter was necessary because of the intense radiation from the AH6 lamp. (auth)

1219

THE ABSOLUTE QUANTITATIVE DETERMINATION OF ACTINIUM BY THE EMANATION METHOD; trans. from Akad. V. I. Vernadskomu k Pyatidesyatiletiyu Nauch. Deyatelnosti 1, 499-516 (1936). V. I. Baranov. 1936. 21p. (NP-2236)

A quantitative determination of actinium by the emanation method in a continuous current of air is reported. In the absence of any absolute comparison standards for actinium, it was necessary to calculate the amount present on the basis of measurement of the ionization current created by actinium emanation (An) in an ionization chamber. The principal difficulties consisted in determining the relationship between the ionization current and the quantity of An in the chamber, and in determining the fraction of the total amount of An present which is actually utilized in the ionization chamber. The first problem was solved by comparing the ionization current produced by a known quantity of Rn introduced into the chamber with that produced by the complete decay of An in the chamber. The degree of utilization of An in the apparatus as a whole was determined by inserting a dry actinium preparation in front of the washing tower containing the solution to be measured. The total quantity of An emitted by the preparation was measured separately. Ac measurements were carried out with an apparatus consisting of a washing tower with a porous glass base containing the solution to be measured, and a Lutz-Edelmann electrometer with two equivalent ionization chambers. (auth)

1220

ALUMINUM OXIDE CONTAINING ALUMINATE FOR CHROMATOGRAPHIC ION ANALYSIS. E. N. Gapon and G. M. Shuvaeva. Doklady Akad. Nauk S.S.S.R. 70, 1007-10 (1950) Feb. 21. (In Russian)

A comparative study of a number of Al_2O_3 preparations led to the following methods for obtaining substances suitable for chromatographic separation of ions. $Al(OH)_3$ is precipitated by CO_2 from a weak solution of $NaAlO_2$ (obtained by dissolving Al in a 30% NaOH solution); the precipitate, calcined at 800°C for 10 min, is an adsorption product $(Al_2O_3)_x AlO_2Na$. Used in a chromatographic column, this preparation separates cations through selective exchange with its Na^+ ion. When destined for the separation of anions, it is previously treated with 1N HNO_3, transforming it into $(Al_2O_3)_x AlO.NO_3$, which separates anions through selective exchange with its NO_3^- ion. All the separations are very satisfactory, and the order in which various ions are adsorbed is that established by Schwab et al. (Angew. Chem. 50, 546, 691(1937)). These latter authors used Merck's preparation of Al_2O_3 (always containing Na) as standardized by Brockmann (later described by Brockman et al. in Ber. 74, 73(1941)).

1221

ANALYTICAL CHEMISTRY OF THORIUM. PART I. SEPARATION FROM CERITE EARTHS WITH o-CHLOROBENZOIC ACID. B. R. Lakshmana Rao and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 457-8(1950) Sept.

Although a double precipitation is required for the separation of Th from the rare earths by the generally known reagents, o-chlorobenzoic acid precipitates Th quantitatively in a single operation from solutions of pH 2.8 to 3.8, the rare earths beginning to precipitate at pH 3.8. The precipitate contains a hydroxyl group. Whereas Cu, Tl, Fe, and quadrivalent Ce interfere in the precipitation, U, Ni, Co, Al, and Pb do not interfere.

1222

ANALYTICAL CHEMISTRY OF THORIUM. PART II. SEPARATION FROM CERITE EARTHS BY o- AND p-AMINOBENZOIC ACIDS. D. S. N. Murthy and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 459-61(1950) Sept.

Thorium can be precipitated quantitatively by o- and p-aminobenzoic acids from solutions of pH 4.2 and higher, although precipitation of rare earths occurs at pH 4.8. The removal of rare earths from monazite requires a double precipitation. Both acids give voluminous precipitates of hydrated thorium aminobenzoate, of which the parasalt has a greater tendency to become colloidal; on the other hand, the interference of various metals is smaller in the latter compound. In part I of this work (J. Indian Chem. Soc.

27, 457-8(1950)) the use of o-chlorobenzoic acid for the same purpose was described.

1223

COLORIMETRIC DETERMINATION AND ESTIMATION OF CERIUM. T. K. S. Murthy and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 383-4(1950) Aug.

Quadrivalent Ce gives a bright yellow color with benzidine in HCl solutions. As little as 0.03 μg can be detected on the spot plate. Trivalent rare earths, Th, Cu, Be, Mg, alkaline earths, Zn, Al, Bi, UO_2^{++}, Mn, Ni, NO_3^-, PO_4^{-3}, Cl^-, F^-, MoO_4^{--}, and $As_3O_4^{--}$ in moderate amounts do not interfere; on the other hand, vanadates and chromates, even in small amounts, cause interference. The reaction can be used for a colorimetric estimation of Ce. (auth)

1224

A COMPARISON OF THE THORIUM NITRATE BACK-TITRATION AND THE SALT-ACID THORIUM TITRATION FOR THE DETERMINATION OF FLUORIDE. Frank A. Smith and Dwight E. Gardner. Arch. Biochem. 29, 311-14 (1950) Dec.

The salt-acid-thorium procedure of Williams, Analyst 71, 175(1946)), is at least as accurate as the back-titration method, is less sensitive to the effects of common interfering ions, and requires only half as much time per titration.

1225

HANDBOOK OF CHEMICAL METHODS FOR THE DETERMINATION OF URANIUM IN MINERALS AND ORES. F. H. Burstall and A. F. Williams. London, His Majesty's Stationery Office, 1950. 22p.

This handbook has been prepared at the request of the Division of Atomic Energy, Ministry of Supply, to provide reliable methods for the determination of uranium in minerals and ores. The analytical procedures described are the outcome of some four years' experience at the Chemical Research Laboratory, Teddington. The methods of the published literature on the subject have been critically examined, and new processes have been devised. The methods in this handbook have been found satisfactory in practice. They are described in full detail so that they can be used by those with little previous experience in the field. No attempt has been made to deal with the underlying theoretical aspects of the analytical chemistry of uranium.

1226

SIMULTANEOUS QUANTITATIVE AND ISOTOPIC ANALYSIS BY ISOTOPE DILUTION. Max Berenbom. Herbert A. Sober, and Julius White. Arch. Biochem. 29, 369-75(1950) Dec.

An isotope-dilution method has been described for the simultaneous quantitative and isotopic analysis of small amounts of material. Factors affecting the accuracy of the method have been discussed, and the lower limits of its practicality with N^{15}-labeled materials have been determined. The method has been applied to the determination of N^{15}-labeled urea in rat urine. (auth)

1227

ZIRCONIUM: ITS ESTIMATION AND SEPARATION. HYDRAZINE SULFATE. Ch. Venkateswarlu and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 27, 395-6(1950) Aug.

Hydrazine sulfate precipitates Zr quantitatively from solutions of pH 2.8 and above. Zr is separated in a single precipitation from Be, Ni, and the rare earths in the pH range 2.8 to 3.0. The separation from Th is more delicate, the pH being critical at 2.8. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1228 AECU-1116

Knolls Atomic Power Laboratory
ON THE POSSIBLE IDENTITY OF RHOMBOHEDRAL AND ORTHORHOMBIC GRAPHITE. Joseph S. Lukesh. [nd.] 2p. (AECU-1116)

Possible relationships between x-ray evidence for the existence of an orthorhombic superstructure in graphite, the satellite reflections observed in single crystal photographs, and extra reflections frequently found in powder photographs of graphite are discussed.

1229

A GEIGER-COUNTER TECHNIQUE FOR THE MEASUREMENT OF INTEGRATED REFLEXION INTENSITY. W. Cochran. Acta Cryst. 3, 268-78(1950) July.

A Geiger-counter spectrometer for single-crystal measurements is described. Two methods are described by which integrated reflection intensity may be measured in a short time, despite the nonlinear response of the Geiger counter to x-ray intensity. Some advantages and disadvantages of the balanced-filter method of monochromatization are pointed out. The relation between counting rate and x-ray intensity is dealt with from both the theoretical and practical points of view. Results obtained with the counter-spectrometer are compared with those obtained by photographic recording. (auth)

1230

AN INTEGRATING WEISSENBERG APPARATUS FOR X-RAY ANALYSIS. E. H. Wiebenga and D. W. Smits. Acta Cryst. 3, 265-7(1950) July.

A modification of the ordinary Weissenberg apparatus is described. With the modified instrument it is possible to measure the integrated reflection intensities with an accuracy equal to, or even better than, that obtained with an integrating photometer, and in a time comparable with that required for visual estimation. The modification consists of a simple mechanical device by which at the end of every translation the camera is given both a small additional movement in the direction of its axis and a small rotation. Each reflection is thereby recorded with a series of slight displacements in two directions. The overlap generates a small parallelogram, the density distribution in which shows a flat plateau in the center. From this the integrated reflection intensity can be directly obtained. Constructional details of the integrating mechanism are given and some results are shown. (auth)

FLUORINE AND FLUORINE COMPOUNDS

1231

ALUMINUM-FLUORINE COMPLEXES IN SOLUTIONS. K. E. Kleiner. Zhur. Obshcheĭ Khim. 20, 1747-59(1950) Oct. (In Russian)

The formation of aluminum-fluorine complex ions was investigated colorimetrically using the reaction between $Fe(NO_3)_3$, KSCN, NaF, and $Al(NO_3)_3$ that leads to an equilibrium between various ions and $AlF_n^{(3-n)}$. The fact that at small F^- concentrations mostly AlF^{++} is formed permitted the determination of the dissociation constant of this complex cation; it is about 10 times as stable as FeF^{++}. Then, with the aid of data on step-by-step dissociations formulated by Babko (Zhur. Obshcheĭ Khim. 15, 745(1945)), dissociation constants of AlF_2^+, AlF_3, AlF_4^-, and AlF_5^{--} were calculated. These constants were employed for the determination of the direction of the reaction $AlF_n^{(3-n)} + 3OH^- = Al(OH)_3 + nF^-$; the formation of $Al(OH)_3$, which is very extensive for n = 1,2, and 3, is considerably inhibited at higher values of n.

1232

INFLUENCE OF A CF_3 GROUP ON AN ADJACENT DOUBLE BOND. II. Albert L. Henne, Malcolm A. Smook, and Ralph L. Pelley. J. Am. Chem. Soc. 72, 4756-7(1950) Oct.

A double bond flanked by a CF_3 group is polarized in a way to make the end carbon more positive than the center carbon, i.e., $CF_3^{-\delta}$ $CH=^{+\delta}$ CH_2, and is sensitive to nucleophilic attack; addition can, however, be superseded by solvolysis of the CF_3 group. In a base-catalyzed reaction, $CF_3CH=CH_2$ and ethanol give mostly the solvolysis product $CH_3CH_2OCF_2CH=CH_2$, but the addition product has been isolated and proved to be exclusively $CF_3CH_2CH_2OCH_2CH_3$. The physical characteristics of this compound were found to differ markedly from those of the isomeric ether, $CF_3CH(CH_3)OCH_2CH_3$, prepared from bromoethane and the alcoholate of the secondary alcohol $CF_3CHOHCH_3$.

GRAPHITE

1233

UNIT-CELL DIMENSIONS OF GRAPHITE. G. E. Bacon. Acta Cryst. 3, 137-9(1950) Mar.

It is shown that the variation with particle size of the c dimension of the graphite unit cell, often reported for small crystallites, can be followed through the range of relatively well-crystallized specimens. The value of c is found to be a linear function of the reciprocal of the number of carbon layers in the crystallite. The a dimension remains constant over this range, although there are small displacements of the hki0 lines, probably because of admixture of a proportion of turbostratic material. (auth)

LABORATORIES AND EQUIPMENT

1234

PLANNING A SMALL RADIOISOTOPE PROGRAM. George W. Reid and Oscar M. Bizzell. Ind. Med. Surg. 19, 549-53(1950) Dec.

A brief but authoritative discussion of the problems involved in setting up an isotope program is presented. Several sources of reliable information on the safe handling and use of radiomaterial, relative costs of the major items required in a radioisotope laboratory, an outline of the waste disposal problem, and examples of some of the cooperative programs in this field are provided. The essentiality of adequate preliminary training is stressed.

RADIATION EFFECTS

1235

ALTERATION OF COLLAGEN STRUCTURE BY IRRADIATION WITH ELECTRONS. Robert R. Perron and Barbara A. Wright. Nature 166, 863-4(1950) Nov. 18. (Letter to the editor)

In studying shrinkage in collagen caused by irradiation with electrons, structural alterations in the material were determined from the low-angle x-ray diffraction patterns of samples which had been exposed in the beam of an electron accelerator. The electron beam used to irradiate the collagen samples was derived from a resonant cavity pulsed by a 10-cm 1-megawatt-type 4J33 magnetron. The rate at which the samples were irradiated was determined to be of the order of 2000 r/sec. Both wet and dry samples of untreated kangaroo tail-tendon collagen were exposed to the electron beam for varying amounts of time. Shrinkage is initiated in the upper half, and uniform shrinkage of the entire fiber is never achieved because, by the time sufficient ionization has occurred at the lower surface, the upper section of the fiber has absorbed so much energy that gelatinization has taken place and the material dissolves. About 98% of the electron beam is absorbed in penetrating collagen samples 0.75 mm in diameter. These findings may be of significance to those employing an electron microscope in the study of collagen.

1236

CHEMICAL EFFECTS OF THE Cu^{63} (γ,n) Cu^{62} REACTION WITH COPPER SALICYLALDEHYDE-o-PHENYLENEDIIMINE. O. G. Holmes and K. J. McCallum. J. Am. Chem. Soc. 72, 5319-20(1950) Nov. (Note)

Copper salicylaldehyde-o-phenylenediimine in both the solid form and in pyridine solution has been irradiated with betatron γ rays of 18 ± 0.5 Mev peak energy and the resulting Szilard-Chalmers reaction studied. The maximum recoil energy imparted to the Cu^{62} nucleus is approximately 0.1 Mev. Carrier copper was separated from the complex, precipitated as CuS, and the activities of the precipitate and residual complex were counted. The retention of activity by the complex has been compared with that resulting from the $Cu^{63}(n,\gamma)Cu^{64}$ reaction (Duffield and Calvin, J. Am. Chem. Soc. 68, 1129(1946)). There was little difference between the retentions when the complex was γ or neutron irradiated in the solid state, although the recoil energies differ by several orders of magnitude. It was found that the bombardment with neutrons of a 0.015M solution of the complex in pyridine gives the same retention as does the irradiation with γ rays of a 0.53M solution. The effect of the concentration of carrier copper in the form of copper acetate during the irradiation is discussed.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1237

THE RARE EARTHS OR "LANTHANONS." A. W. Wylie. Roy. Australian Chem. Inst. J. Proc. 17, 377-97(1950) Oct.

An extensive review of the lanthanon elements is presented. Evidence for the electronic structures from atomic-volume data, x-ray-diffraction patterns, optical spectra, magnetic data, and absorption spectra are given, types of compounds are briefly summarized, and separation methods are discussed. 47 references.

SEPARATION PROCEDURES

1238

COUNTERCURRENT CONDENSATION WITH SIMULTANEOUS COMPONENT EXCHANGE IN TWO-COMPONENT MIXTURES. P. Grassmann. Ann. Physik 7, 54-62(1950) Feb. 10. (In German)

For the case of a two-component mixture, a theoretical study is made of concentration changes occurring, both in the liquid and the vapor phases, during simultaneous processes of condensation and rectification along a vertical or a slanting wall. If the equilibrium curve, characteristic of a given mixture, is replaced by a straight line, the above concentration changes can be described by a series formula, from which simple relationships governing several special cases are derived. (auth)

1239

ION EXCHANGE REACTIONS WITH THE FORMATION OF DIFFICULTLY SOLUBLE PRECIPITATES. O. N. Grigorov and A. I. Tarshis. Kolloid. Zhur. 11, 390-4(1950) Nov.-Dec. (In Russian)

Ion exchanges accompanied by the formation of difficultly soluble precipitates have received but little attention; they are generally believed to be irreversible processes. In this work reactions $AgCat + BaCl_2 \rightarrow BaCat + AgCl$ and $BaCat + K_2SO_4 \rightarrow KCat + BaSO_4$ were investigated, Cat representing permutite, glauconite, and two other adsorbers. These reactions, carried out under shaking with powdered adsorbers, alternated (three times) with the action of solutions of $AgNO_3$ or $BaCl_2$ upon the corresponding adsorber (BaCat or KCat). In this way the perfect reversibility (within experimental errors) of the processes was proved, by showing that the precipitation occurred in the solution after a regular cation exchange had taken place on the adsorptive surface.

SORPTION PHENOMENA

1240

THE VARIATION OF RATE OF DESORPTION WITH EXTENT OF SURFACE COVERAGE. Joseph Weber and Keith L. Laidler. J. Chem. Phys. 18, 1418(1950) Oct. (Letter to the editor)

In connection with a study of the catalyzed ammonia-deuterium exchange reaction, using the technique of microwave spectroscopy to determine NH_3 concentrations, it has been demonstrated directly that rates of desorption are markedly increased as the surface becomes more fully covered. These results cannot be explained on the basis of variability of the catalyst surface, but only in terms of repulsive forces. Since the rates of catalyzed reactions are sometimes controlled by desorption rates, it follows that surfaces may be rendered more active catalytically by the adsorption of reactant or other molecules.

SPECTROSCOPY

1241

ROTATIONAL ISOMERISM IN PERFLUORO PARAFFINS. G. J. Szasz. J. Chem. Phys. 18, 1417-18(1950) Oct. (Letter to the editor)

The infrared absorption spectra of gaseous, liquid, and crystalline $n\text{-}C_5F_{12}$, $n\text{-}C_6F_{14}$, and $n\text{-}C_7F_{16}$ in the region 9 to 13 μ have been determined and will be presented in a later report. In addition, quantitative intensity measurements were made on appropriately chosen pairs of lines belonging to different isomers as a function of temperature in the liquid phase. The results are very similar to those obtained for the corresponding hydrocarbons. In the absence of additional information it is assumed that the extended, zig-zag form again represents the most stable configuration and is the only one present in the solid.

SYNTHESES

1242

COMPOUNDS OF GERMANIUM AND HYDROGEN. III. MONOALKYLGERMANES. IV. POTASSIUM GERMANYL. V. ELECTROLYSIS OF SODIUM GERMANYL. Gordon K. Teal and Charles A. Kraus. J. Am. Chem. Soc. 72, 4706-9 (1950) Oct.

Methyl-, ethyl-, and propylgermanes have been prepared by the reaction of $NaGeH_3$ with the appropriate alkyl halides in liquid NH_3. The reaction of CH_2Br_2 with $NaGeH_3$ is complex; the chief product is CH_3GeH_3. $KGeH_3$ has been prepared by reaction of monogermane with potassium metal in liquid NH_3. One mole of $KGeH_3$ is soluble in 4.604 moles of NH_3; the vapor pressure of the saturated solution is 20.4 cm at $-33.3°C$. On electrolyzing $NaGeH_3$ between a Pt anode and Hg cathode, a reaction occurs at the anode; $6GeH_3^- + 2NH_3 = 6GeH_4 + N_2 + 6e^-$. When electrolysis of the salt is substantially complete, H_2 and N_2 are evolved in a molar ratio of 3/1; NH_3 is electrolyzed. On electrolysis of $NaGeH_3$ between two Pt electrodes, H_2 and N_2 are evolved in a molar ratio of 3/1. A small amount of GeH_4 is evolved initially. On electrolyzing $NaNH_2$ between a Pt anode and Hg cathode, little current passes because of the low solubility of the amide. A small quantity of gas was evolved of molecular weight 22, probably N_2 admixed with H_2. (auth)

1243

PREPARATION OF PRACTICALLY CARRIER-FREE Cu^{64} OF HIGH ACTIVITY FROM Cu-PHTHALOCYANINE. W. Herr and H. Götte. Z. Naturforsch. 5a, 629-30(1950) Nov. (Note; in German)

Duffield et al. (J. Am. Chem. Soc. 68, 1129(1946)) used Cu-salicylaldehyde-o-phenylenediimine for the preparation of Cu^{64} by the Szilard-Chalmers method. The present authors have replaced that complicated and expensive compound with Cu-phthalocyanine, a known dye easily prepared in the laboratory, whose flat molecule makes it particularly suitable for the Szilard-Chalmers process. Its property of being precipitated by water from a solution in concentrated H_2SO_4 is used for the separation of the Cu^{64} obtained in the $Cu^{63}(n,\gamma)$ reaction. However, adsorption on Cu-phthalocyanine greatly reduces the yield. This is prevented by an addition of ZnS, whereby Zn is adsorbed in place of Cu. Yields of from 25 to 40% of a practically carrier-free preparation are obtained.

1244

SYNTHESIS OF dl-AMPHETAMINE SULFATE LABELED WITH C^{14}. James W. Wilson, III. J. Am. Pharm. Assoc. Sci. Ed. 39, 687-8(1950) Dec.

Benzedrine, dl-amphetamine neutral sulfate, labeled with C^{14} in the position adjacent to the benzene ring has been synthesized from methylene-labeled phenylacetic acid in 38% yield. Specific activity of the product is 7.55×10^3 c/sec/mg.

1245

SYNTHESES WITH ISOTOPIC TRACER ELEMENTS. PART I. THE PREPARATION OF METHANOL AND SODIUM ACETATE LABELED WITH CARBON ISOTOPES. J. D. Cox, H. S. Turner, and R. J. Warne. J. Chem. Soc., 3167-76(1950) Nov.

A critical study of methods for the synthesis of methanol, methyl iodide, and acetic acid containing carbon isotopes has been carried out. Methods are described for the preparation of these intermediates in good yield and high purity from potassium cyanide or barium carbonate on the scale of 1 to 250 millimoles. (auth)

1246

SYNTHESES WITH ISOTOPIC TRACER ELEMENTS. PART II. THE PREPARATION OF ETHANOL LABELLED WITH CARBON ISOTOPES. J. D. Cox and H. S. Turner. J. Chem. Soc., 3176-80(1950) Nov.

Methods are described for the conversion of sodium acetate labled with carbon isotopes into acetyl chloride and ethanol. Excellent yields of good-quality material have been obtained on the 5- to 15-millimoles scale. (auth)

TRACER APPLICATIONS

1247

Oregon State College
ISOTOPIC EXCHANGE REACTIONS OF LIQUID SULFUR TRIOXIDE AND SULFUR DIOXIDE. J. L. Huston. [nd.] 14p. (AECU-1105)

No isotopic exchange of sulfur takes place at room temperature when sulfur trioxide is dissolved in liquid sulfur dioxide or when sulfur dioxide is dissolved in liquid sulfur trioxide, and exchange occurs only slowly at 132°. It is suggested on the basis of these results and of work by Nakata (J. Chem. Soc. Japan 64, 635-8(1943) that the two compounds undergo rapid exchange of oxide ions at room temperature, interacting as a Lewis acid and a Lewis base but not undergoing oxidation-reduction interaction. Sulfur trioxide reacts with potassium pyrosulfite at room temperature, converting it to potassium sulfate and potassium dipyrosulfate. The process induces a small amount of exchange between sulfur dioxide and sulfur trioxide, indicating that some oxidation-reduction interaction takes place under these conditions. Isotopic exchanges of sulfur trioxide with barium sulfate and with potassium sulfate were observed. When potassium sulfate and sulfur trioxide react to form potassium dipyrosulfate substantial, and possibly complete, exchange occurs between excess sulfur trioxide and the sulfur originally in potassium sulfate. (auth)

TRITIUM AND TRITIUM COMPOUNDS

1248

ON THE MECHANISM OF ELECTROPHILIC AROMATIC SUBSTITUTION. AN INVESTIGATION BY MEANS OF THE EFFECT OF ISOTOPIC MASS ON REACTION VELOCITY. Lars Melander. Arkiv Kemi 2, No. 3, 211-92(1950).

The development and the present state of the theory of aromatic substitution has been reviewed. It has been pointed out that although the factors governing the ease and direction of the electrophilic attack on simple benzene derivatives are rather well known, very little is known about the mechanism of the displacement of the hydrogen. The different possible mechanisms of the replacement of the hydrogen have been discussed. It has been shown that isotopic hydrogen behaves differently in different alternatives. The arrangement of experiments with tritium in order to decide which of the alternatives corresponds to the true mechanism has been discussed. The behavior of different isotopes according to the theory of absolute reaction rates has been reviewed and the principles applied to the present problem. The variation of isotopic concentrations in isotopic reactions has been treated mathematically, and the formulas necessary for the computation of the ratio between the rates of tritium and protium substitutions from the results have been deduced. The preparative methods available for the introduction of isotopic hydrogen into organic molecules have been reviewed. Benzene-t, naphthalene-α-t, and the different isomerides of toluene-t and bromobenzene-t have been prepared in radiochemical quantities by means of the Grignard reaction. Benzene-t has also been prepared by exchange. The following substitution experiments have been conducted: m-dinitration of benzene and 2,4-dinitration of toluene and bromobenzene with mixed sulfuric and nitric acids; α-nitration of naphthalene with nitric acid; p-dibromination of benzene and p-bromination of bromobenzene with aluminum chloride, ferric bromide, and iodine as catalysts; and sulfonation of benzene and p-sulfonation of bromobenzene with oleum.

URANIUM AND URANIUM COMPOUNDS

1249 UR-132

University of Rochester Atomic Energy Project
SPECTROPHOTOMETRIC STUDIES OF THE URANYL: CITRATE SYSTEM IN ACID SOLUTION. I. Feldman and W. F. Neuman. Aug. 11, 1950. 15p. (UR-132)
UNCLASSIFIED

Absorption spectra, together with the results obtained by the method of continuous variations, indicate that there exist but two citrate-complexes of uranyl ion over the pH range 2.0 to 3.64; a highly associated complex with a molar ratio of unity and a more dissociated complex of combining ratio 2, uranium/citrate. The dissociation of both complex ions is increased by lowering the pH of the solution. (auth)

ENGINEERING

1250

SONIC PRECIPITATION OF SMOKE, FUMES AND DUST PARTICLES. Melvin Nord. Chem. Eng. 57, No. 10, 116-19(1950) Oct.

A discussion on sonic precipitation theory, collision mechanisms, historical background, use in smoke abatement, patents, and future utility is presented. 48 references.

HEAT TRANSFER

1251

Alfred University
AN UNSTEADY-STATE METHOD FOR MEASURING THERMAL DIFFUSIVITY AT HIGH TEMPERATURES. Herman S. Levine. June 15, 1950. 31p. (NP-1603)

An unsteady-state method for measuring thermal diffusivity at high temperatures has been developed in which experimental heating curves are compared with the simplified solution of the heat-conduction problem for various bodies. This method is based on a radiation boundary condition. The thermal diffusivity of refractory oxides measured by this method at 1400°C compares favorably with reported values. The apparatus used was a modification of standard laboratory equipment. Experimental procedures were simple, and results were obtained rapidly. (auth)

TRACER APPLICATIONS

1252

IMPROVED RADIOACTIVE-TRACER CARRIER FOR METAL CLEANING STUDIES. J. C. Harris, R. E. Kamp, and W. H. Yanko. ASTM Bull. 170, TP 308-9(1950) Dec. (See also NSA 3-328)

This paper discusses the use of an oil-soluble tracer compound which is not chemisorbed and compares the results with those obtained using N,N-di-n-butyl stearamide. The compound chosen for this work was n-undecane since this was synthesized fairly readily by usual laboratory techniques to include an atom of C^{14}.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1253

CERAMICS AND ATOMIC ENERGY. Wingate A. Lambertson. Am. Ceram. Soc. Bull. 30, No. 1, 18(1951) Jan.

A brief article is presented in which it is indicated that ceramics will be used in the production of atomic power as service material for metallurgical fabrications and in ceramic structural and fuel elements for reactors.

GEOLOGY AND GEOPHYSICS

1254

GEOLOGY AND RADIOACTIVITY OF THE MEDICINAL HOT MINERAL BATHS OF AREQUIPA. Alejandro Freyre. Bol. soc. quím. Peru 16, 105-22(1950) June. (In Spanish)

This investigation was reported in the Minutes of Meetings and Proceedings of the Third Peruvian Congress of Chemistry, 737-54(1949) Oct. 17-23, and was abstracted in Nuclear Science Abstracts as abstract 4-6129.

1255

ON THE RADIOACTIVITY OF POTASSIUM. Harold Jeffreys. Ann. geophys. 6, No. 1, 10-17(1950).

Recent data on the radioactivity of potassium are discussed. The rate of decay of K^{40} to Ca^{40} is fairly well determined as $\lambda_\beta = (0.51 \pm 0.04)/10^9$ year, but there are considerable inconsistencies in the rate of decay to A^{40}. Data given by Ahrens and Evans (Phys. Rev. 74, 279-86(1948)) for accumulation of Ca in old micas indicate $\lambda_e = (1.91 \pm 0.16)/10^9$ years, but this needs further check as systematic errors are possible. $\lambda_e = 0.36/10^9$ years is a least possible value from accumulation of A^{40} in KCl. The amount of argon in the atmosphere might be consistent with

the former value of λ_e if the age of the earth is 2100 million years, on the drastic hypothesis that undenuded granites have lost none of their argon. It cannot be reconciled with a greater age even on that hypothesis. To reconcile the argon content of the atmosphere with Holmes's estimate of 3300 million years for the age of the earth would require λ_e to be less than $1.4/10^9$ years. Even the latter value would make general solidification impossible more than 1400 million years ago unless K is more closely concentrated to the surface than has been usually supposed; but such a concentration appears to be free from theoretical objection.

METALS AND METALLURGY

1256

Westinghouse Research Laboratories
CREEP-RUPTURE TESTS OF BERYLLIUM. M. J. Manjoine. June 2, 1947. Decl. Jan 9, 1951. 8p (AECD-3036)

A series of creep-rupture tests of specimens of beryllium has been completed at 1700°F, and the results are summarized in this report. Tests on beryllium are being continued at 1400, 1550, and 1700°F.

1257

Westinghouse Research Laboratories
CREEP-RUPTURE TESTS ON BERYLLIUM. M. J. Manjoine. Jan. 14, 1947. Decl. Jan. 9, 1951. 2p (AECD-3037; SM-564(WRL))

A specimen of beryllium has been tested at 350 psi and 1700°F in an atmosphere of tank helium on a screw-driven creep machine. Creep and loading curves are given.

1258

Westinghouse Research Laboratories
SHORT TIME, HIGH TEMPERATURE TENSILE TESTS OF BERYLLIUM. Frederick C. Hull. Aug. 9, 1948. Decl. Jan. 9, 1951. 50p. AECD-3038; SR-393(WRL))

Short-time tensile properties of pure beryllium have been determined from room temperature up to 1550°F. Below 900 to 1000°F beryllium fails by cleavage; above 1400°F it fails by intercrystalline cracking. Between 900 and 1400°F there is a gradual change in the proportion of the area of the fracture resulting from each of these two mechanisms of rupture. No shearing failures were encountered during this work. Grain growth characteristics of beryllium were investigated. Grain size and method of preparation have a pronounced effect on properties, especially ductility as related to temperature of testing. (auth)

1259

Westinghouse Research Laboratories
CREEP-RUPTURE TESTS OF BERYLLIUM. M. J. Manjoine. Mar. 10, 1948. Decl. Jan. 9, 1951. 18p. (AECD-3041; SR-373(WRL))

A program of creep-rupture tests of several bars of beryllium has been completed. The tests were made at 1200, 1400, 1550, and 1700°F in protective atmospheres of tank halium or hydrogen. The results are given in a summary table and by creep and design curves. A description of the test setup is included. (auth)

1260

Knolls Atomic Power Laboratory
METHOD AND RESULTS OF SODIUM WETTING TESTS. H. H. Winkler and L. B. Vandenburg. Dec. 27, 1949. 9p. (KAPL-P-231)

This report presents the method used and the results of 43 tests made to determine the relation between sodium wetting temperatures and surface conditions of various materials. (auth)

1261

M.I.T. Department of Metallurgy
THE THERMODYNAMIC PROPERTIES OF LIQUID TERNARY CADMIUM SOLUTIONS. John F. Elliott and John Chipman. Dec. 29, 1950. 51p. (NYO-572)

The ternary systems, cadmium-lead-bismuth, cadmium-lead-antimony and cadmium-lead-tin have been investigated in the liquid phase by electrode-potential methods over the temperature interval of 380 to 600°C. Darken's methods (J. Am. Chem. Soc. 72, 2909(1950)) have been utilized to determine the molal and partial molal properties, free energy, heat of solution and entropy. An electrode-potential method was used to evaluate the thermodynamic properties of cadmium for several pseudobinary lines crossing each of the ternary fields in the systems.

1262

American Smelting and Refining Co.
PROGRESS REPORT NO. 2; SEPTEMBER 16 - DECEMBER 15, 1950; PROBLEM NO. 539. J. L. Everhart and E. L. Van Nuis. Jan. 2, 1951. 8p. (NYO-761)

In static tests, samples of various constructional materials are exposed to attack by liquid low-melting alloys for 500 hr at 1200°F. Tests have been run, during the period, on four samples of Ti-base alloys in contact with Bi-Pb, Bi-Pb-Sn, Bi-Pb-In, and Bi-In-Pb-Sn alloys. Tests were run also on commercial Ti and stainless steel type 316 in contact with Bi-In-Pb-Sn. Two Ti alloys, one containing 4% Cr and the other 4% Cr and 3% Al, have resisted attack under these conditions as well as the high Cr stainless steels, which were the best of the materials tested previously. In dynamic tests, samples of constructional materials have been exposed to attack by various liquid low-melting alloys for 1000 hr under dynamic conditions (slow-circulation) in a series of corrosion harps. Two samples are included in each run, one polished, the other with the surface "as received" from the supplier. Type 446 steel submerged in Bi-Pb showed little attack, the results being similar to those obtained previously under static conditions. The "as received" samples were attacked at slightly greater rates than the polished samples. However, samples exposed to attack by the Bi-In-Pb alloy were attacked at a greater rate under dynamic than under static conditions, with the polished sample showing a

higher rate of attack than the "as received" sample. The 4% Cr-Ti alloy tested in Bi-Pb at 900°F showed mild attack. A capillary viscometer has been constructed of pyrex glass to determine the viscosities of a number of the low-melting alloys which were developed during the early stages of this investigation. A Jacobs viscometer is described based on the principle of measuring the torque exerted on a rotating body which is immersed in a liquid.

1263

Pennsylvania State College
THE CORROSION OF ZIRCONIUM; FIRST QUARTERLY REPORT. Harold J. Read. Dec. 31, 1950. 7p. (NYO-835)

The activities of the Senior Investigator with respect to the acquisition of background information on the corrosion of zirconium are reported. Plans for the initial experimental work on the project are outlined. They involve a study of the formation of corrosion products on thin films of zirconium. This approach will permit the use of transmission methods for the study of the corrosion products by electron diffraction and electron microscopy. (auth)

1264

LITTLE KNOWN RUSSIAN WORKS ON METAL CORROSION. S. A. Balezin and V. P. Barannik. Uspekhi Khim. 19, No. 5, 641-2(1950). (In Russian)

It is generally stated in treatises on acid corrosion of metals that the systematic experimentation in this field belongs to the present century. It may be noted, however, that as early as 1881 Kayander published an investigation on many aspects of the dissolution of metals in acids (Zhur. Russ. Fiz. Khim. Obshchestva 13, Part I (1881)). Two other early Russian works are: Onufrovich (Zhur. Russ. Met. Obshchestva, 203(1910)) on the rusting of roof iron, and Kuklin (ibid., 238(1910)) on the hydrogen brittleness of metals.

1265

University of California Institute of Engineering Research
METALLURGICAL INVESTIGATIONS CONCERNED WITH THE BEHAVIOR OF MATERIALS IN AN ENVIRONMENT OF LIQUID LEAD-BISMUTH ALLOY. R. C. Grassi, D. W. Bainbridge, and R. O. Elliott. Sept. 1950. 59p. (NP-1881)

Stress-rupture properties at 1000°F of five low alloy and stainless steels are presented for environments of helium, hydrogen, and liquid lead-bismuth alloy of eutectic composition. Experiments designed to produce wetting of steels by liquid lead-bismuth are described. The methods include controlled atmospheres, electroplating, and fluxing. The problem of wetting is discussed in relation to solution rate, and equilibrium solution determinations. Results of static type solution tests at 1400°F are given. (auth)

1266

University of Pennsylvania Towne Scientific Laboratory
PREPARATION OF SINGLE CRYSTALS OF BERYLLIUM AND ZIRCONIUM; STUDY OF MECHANICAL PROPERTIES; QUARTERLY REPORT; JULY 1, 1950, TO SEPTEMBER 30, 1950. R. M. Brick, H. T. Lee, and H. Greenewald. 1950. 6p. (NP-1836)

Fifteen single-crystal specimens of beryllium have been prepared, and tests of those under compression are under way. Compressed normal to the basal plane at room temperature, no plastic behavior was observed and deformation was apparently solely elastic up to a stress of about 285,000 psi at which point fracture occurred. Compressed parallel to the basal plane, (10T2) twinning was observed and a critical stress calculated. Some zirconium which is substantially free of second phase in certain areas, at least, has been obtained and is being annealed for single-crystal production. Simultaneously, work is proceeding on the hardness, microstructure, and precision lattice parameter changes of zirconium with addition of oxygen and nitrogen.

1267

PRODUCTION OF CAST SLABS, BLOCKS, AND SHAPED ARTICLES FROM ALLOYS OF MAGNESIUM WITH ZIRCONIUM. F. Sauerwald. Chem. Technik 2, 183-5 (1950) June. (In German)

Results of experiments on the fabrication of cast products from Mg alloys containing 1 to 2% Zr, alone or in combination with Zn and other metals, are described.

1268

Ohio State University Cryogenic Laboratory
VAPOR PRESSURE OF INORGANIC SUBSTANCES; V. TANTALUM BETWEEN 2624° AND 2943°K; TECHNICAL REPORT NO. 6. James W. Edwards, Herrick L. Johnston, and Paul E. Blackburn. July 15, 1950. 15p. (NP-1933)

The vapor pressure of tantalum was determined over the temperature range 2624 to 2943°K by measuring the rate at which a metal surface evaporates in vacuum. Values of ΔH_0° were calculated from the individual vapor pressures and showed no appreciable trend, the average value being 185.5 ± 0.3 kcal. By combining this value with free-energy functions for solid and gaseous tantalum, the following vapor-pressure equation was obtained, $R \ln p = \frac{-185.5 \times 10^3}{T} + 3.7 \times 10^{-4} T - 8.4 \times 10^{-8} T^2 + 32.87$. Our experimental results agree accurately with the earlier work of Langmuir and Malter (Phys. Rev. 55, 743(1949)), but disagree with those of Fiske (Phys. Rev. 61, 513(1942)).

1269

Ohio State University Cryogenic Laboratory
THE VAPOR PRESSURE OF INORGANIC SUBSTANCES; V. ZIRCONIUM BETWEEN 1949 AND 2054°K; TECHNICAL REPORT NO. 7. Gordon B. Skinner, James W. Edwards, and Herrick L. Johnston. July 27, 1950. 17p. (NP-1818)

The vapor pressure of zirconium has been determined in the temperature range 1949 to 2054°K by measuring the rate at which a zirconium surface evaporates into a vacuum. Values of ΔH_0° have been calculated from the individual vapor

pressures and show no appreciable trend, the average value being 142,150 ± 350 cal/mole. By combining this value with free-energy functions of gaseous zirconium and with extrapolated values for the solid, the following equation for vapor pressure is obtained: $\log_{10}P_{atm} = -\frac{31,066}{T} + 7.3351 - 2.415 \times 10^{-4}T$. (auth)

1270

ZIRCONIUM. G. L. Miller. Ind. Chemist 26, 435-41(1950) Oct.

A general description is given of the industrial preparation, working, and properties of zirconium. 6 figures.

MINERALS AND MINERALOGY

1271

ACTION OF TITANIUM TETRACHLORIDE ON ILMENITE. Claude Pascaud. Compt. rend. 231, 1232-3(1950) Nov. 27. (In French)

The removal of iron and other oxides, with the exception of silica and alumina, from the titanium mineral ilmenite has been accomplished by reacting the mineral with titanium tetrachloride vapor at 850°C under 30 mm Hg. The iron and other contaminants sublime as the chlorides. Effects of variations in conditions of temperature and pressure are discussed.

1272

CONTRIBUTIONS TO THE KNOWLEDGE OF THE CHEMISTRY OF THE RADIOACTIVE MINERALS OF FINLAND. Lauri Lokka. Bull. comm. géol. Finlande, No. 149, 1-83(1950).

The chemical compositions of ilmenite, titanite, spessartite, gadolinite, the thorium minerals allanite, monazite, nuolaite, and loranskite, and the uranium mineral wiikite from various occurrences in Finland are given. The analytical methods used are discussed, and the age of some of the minerals have been determined.

1273

GERMANIUM IN THE COAL OF RIO TURBIO. Siegfried G. Lexow and Ernesto P. P. Maneschi. Anales asoc. quím. argentina 38, 225-9(1950) Sept. (In Spanish)

From 0.18 to 0.27% GeO_2 was found in samples of coal from Rio Turbio, Argentina, the corresponding ash contents being 10.4 and 8.4%. The coal also contains up to 0.04 g of U per ton of coal, traces of V, and up to 3.5 g of TiO_2 per 100 g of ash.

1274

HUTTONITE, A NEW MONOCLINIC THORIUM SILICATE. A. Pabst. Am. Mineral. 36, 60-5(1951) Jan.-Feb.

The name huttonite is given to a mineral of composition $ThSiO_4$, isostructural with monazite. It has been isolated in minute grains from beach sands of South Westland, New Zealand. It is monoclinic; sp. gr. 7.1; $\alpha = 1.898$, $\beta = 1.900$, $\gamma = 1.922$; dispersion $r < v$, moderate; $2V = 25°$; $Y \| b$, Z near c; colorless to very pale cream. Space group $C_{2h}^5 - P2_1/n$; $a_0 = 6.80$ A, $b_0 = 6.96$, $c_0 = 6.54$ A, $\beta = 104°55'$; cell content $4(ThSiO_4)$. (auth)

1275

OCCURRENCE, OPTICAL PROPERTIES AND CHEMICAL COMPOSITION OF HUTTONITE. C. Osborne Hutton. Am. Mineral. 36, 66-9(1951) Jan.-Feb.

The mineral, a thorium silicate with physical properties distinct from those of tetragonal thorite, is monoclinic with the same symmetry as monazite. Occurrence, physical properties, sources, etc., are reported. 13 references.

1276

PETROLOGY OF THE RED RADIOACTIVE ZONES NORTH OF GOLDFIELDS, SASKATCHEWAN. Charles E. B. Conybeare and Charles D. Campbell. Am. Mineral. 36, 70-9(1951) Jan.-Feb.

The red rocks that occur along faults and shear zones in the Precambrian granitic terrane north of Lake Athabaska are more radioactive than others in the area. They are mylonites ranging from protomylonite to ultramylonite, the latter generally forming anastomosing veinlets in the less intensely crushed types. In the protomylonites the feldspar is deformed albite colored with hematite dust, especially along the cleavages; unstrained minerals fill the interstices. In the more intensely crushed types the hematite dust permeates most of the rock; the unstrained minerals present form scattered aggregates or may locally replace the mylonite completely. The first of these late minerals is clear albite, which forms rims on the red albite relicts. Then follow, in variable order and with repetitions, clear subhedral quartz and albite, specularite, and penninite containing radioactive anatase grains. The latest veins contain also pitchblende, calcite, and specularite. Oxidation products of pitchblende are locally abundant in solution cavities. The early iron and later radioactive elements were introduced probably by solutions that rose along the mylonite zones. The other elements were probably present before mylonization; and all the late minerals, excepting pitchblende and calcite, may be products of recrystallization. The dusty hematite was probably not formed either by radioactive bombardment of ferrous minerals or by unmixing of iron-feldspar. 16 references. (auth)

1277

THORITE FROM CALIFORNIA, A NEW OCCURRENCE AND VARIETY. D. R. George. Am. Mineral. 36, 129-32(1951) Jan.-Feb.

The occurrence of green thorite is not recorded in the literature, nor has thorite from California been previously described. The mineral is widely distributed in the major gold placers of California, and is probably derived from the weathering of Jurassic granites. Physical and optical properties and a chemical analysis are presented. (auth)

PHYSICS

1278

Office of Naval Research, London
CONFERENCE ON THE PROPERTIES OF SEMICONDUCTING MATERIALS, UNIVERSITY OF READING, ENGLAND, JULY 10-15, 1950. P. W. Forsbergh, Jr., and P. M. Marcus. Sept. 12, 1950. 47p. (ONRL-97-50)

In addition to the work reported on the semiconducting properties of germanium, research progress was reported on the following: semiconducting properties of gray tin, barium oxide, and silicon; the effect of neutron irradiation on semiconductors; the transistor action in lead sulfide; the trapping of electrons released in alkali halide crystals; and the preparation of black phosphorus at atmospheric pressure by a catalytic method.

1279

REMARKS ON THE MECHANISM OF ASCENDING DIFFUSION H_2-O_2 FLAMES. K. Clusius. Z. Naturforsch. 5a, 514(1950) Sept. (Note; in German)

Taylor has pointed out that the velocity of the ascending "mushroom" head, produced by the explosion of the atomic bomb, obeys a law that also governs the rising of large lens-shaped air bulbs in water or nitrobenzol (Proc. Roy. Soc. (London) 201A, 159,175(1950); Davies and Taylor, ibid. 200A, 375(1950)). The steady spherical calotte of the upper surface is determined by potential flows of pressure in the gas, while the irregular and changing undersurface is formed by turbulences and is followed by a turbulent stem. Taylor (ibid.) showed that the ascending velocity depends only on the sphere radius of the calotte, viz. $v = 0.78(gr)^{1/2}$, where g is the gravity acceleration. These findings led the author to the assumption that an analogous mechanism might underlie the movements of small ($r = 2$ mm) hemispherical flames (Böhm and Clusius, Z. Naturforsch. 3a, 389(1948)) with a turbulent underface, which were obtained from $H_2 + O_2$ mixtures and whose ascending velocity was about 25 cm/sec. The fact that this value is higher than $v = 11$ cm/sec, furnished by the foregoing formula, is due to the superimposition of a chemical reaction fed by the surrounding gas mixture, into which the reaction front is continuously drawn in.

COSMIC RADIATION

1280

University of California Radiation Laboratory
ANGULAR AND RADIAL DISTRIBUTIONS OF PARTICLES IN CASCADE SHOWERS. L. Eyges and S. Fernbach. Oct. 5, 1950. 45p. (UCRL-943)

The calculation of the angular and radial distributions of electrons and photons at the maximum of a cascade shower has been carried out. As a preliminary, evidence is presented that distribution functions of the same general shape as those sought can be calculated over most of their range from a knowledge of their moments. The moments of the distribution functions in a shower neglecting collision loss of electrons, i.e., for energies E much greater than the critical energy ℓ, are calculated. Expressions are derived for the moments when collision loss is not negligible. These expressions are in the form of a series in ℓ/E, and are valid down to a few times the critical energy. The moments then are used to calculate the distribution functions for energies down to a few times the critical energy. (auth)

1281

COSMIC RAY STUDIES WITH THE AID OF SPECIAL PHOTOGRAPHIC EMULSIONS. Pierre Demers. Can. J. Research 28A, 628-55(1950) Nov. (In French)

Stacks of 150-μ sheets of fine-grain nuclear emulsions prepared by the author were exposed during balloon flights at altitudes of 25 to 35 km. The preparation and handling of the unsupported sheets are described. The effectiveness of the method of superposition, evaluated as being the probability that a track would be visible in the sheet toward which it was heading, was 86%. Among other high-energy events was observed a double star with a 200-Mev proton giving a track 1630 μ in length as the intermediate particle, the energy of the incident particle being about 1315 Mev. The almost symmetric disintegration of C^{12} into three α particles of weak energy was observed. Simple stars having only one long branch (meson, proton, triton, α) and a short-path recoil nucleus were found. These would have escaped detection in commercial emulsions. Four of a total of 31 stars observed were simple. An optical pantograph and an apparatus for making continuous microphotographs are described, and a current investigation on the anisotropy of cosmic rays is summarized.

1282

A CRITICAL EXAMINATION OF THE GRAVITATIONAL THEORY OF THE ORIGIN OF COSMIC RAYS. P. J. D. Gething. Proc. Roy. Soc. (London) 204A, 278-94(1950) Dec. 7.

The observational data which any theory of the origin of primary cosmic radiation should explain and the comparative merits of the various theories so far propounded are examined. In particular, Milne's suggestion concerning a possible gravitational acceleration in intergalactic space is considered in detail, and his somewhat involved analysis is replaced by a simpler method of derivation by means of an alternative time scale. The energy spectrum and possible total intensity of gravitationally accelerated material are examined; it is shown that an expression can be obtained for the former which is consistent with cosmic-ray data, but because the world-model considered is not sufficiently sharply defined, no order of magnitude can be obtained for the latter. It thus appears that a gravitational theory of cosmic radiation can account for most of the main features of the observational data, and as regards the remaining features, although the present theory is incomplete, it presents no actual inconsistencies with observation. (auth)

1283

DECAY ENERGY OF BERYLLIUM-8 NUCLEI OBSERVED IN COSMIC RAY STARS. J. Crussard. Nature 166, 825 (1950) Nov. 11. (Letter to the editor).

During an examination of about 3000 stars in Ilford G5 plates exposed at balloon altitude, several cases were observed of two prongs of comparable length, making a small angle with each other, ending in the emulsion, and having the appearance of 10- to 20-Mev α particles. On the assumption that such pairs are Be^8 decay products from the reaction $Be^8 \rightarrow 2He^4 + Q$, the energy Q can be easily computed in the center-of-mass system from the range of the α particles and the initial angle of their tracks. A rather narrow band of energy for the value of Q was found 100 kev (16 pairs between 63 and 100 kev). A broader and lower peak was also observed around 600 kev (12 pairs between 500 and 750 kev). Only four cases were found outside these two peaks. The 100-kev peak is attributed to Be^8 nuclei, emitted in the ground state. Q has the value 85 ± 10 kev, in good agreement with previous investigations. The broader band around 600 kev may indicate the existence of some other nuclear process.

1284

DISCRIMINATION BETWEEN COINCIDENCES OBSERVED IN COUNTERS SURROUNDED BY LEAD, AS DUE EITHER TO PENETRATING ATMOSPHERIC SHOWERS OR TO LOCAL EFFECTS IN LEAD. André Fréon. J. phys. radium 11, 691-6(1950) Dec. (In French)

A flat group of 3 counters connected in parallel, placed either vertically or horizontally within a Pb block, records coincidences both with 3 other counters, each surrounded by Pb of the same block, and with a group of 10 counters (in parallel) placed outside the block. It is found that, at distances between the first group and the other counters in Pb equal to about 20 cm, at least 85% of coincidences are attributable to local effects in Pb, the remaining events being due probably to associated penetrating particles from the air. A certain fraction of the local effects (at least among those observed as coincidences in the 3 counters each surrounded by Pb) is probably produced by secondaries from mesons. It is thus shown that a particle entering dense matter acts not only along its path, but also at a distance, by way of secondary effects. This removes the difficulty of interpreting events within filters as due to penetrating showers coming from the air, when the mean radiation density in the filter is much higher than in the surrounding air. (auth)

1285

EMISSION OF Li_3^8 NUCLEI IN COSMIC RAY STARS. E. Pickup and L. Voyvodic. Can. J. Research 28A, 616-27 (1950) Nov.

One of the more interesting features of cosmic-ray stars is that Li^8 nuclei are ejected occasionally in the nuclear disintegrations. Such nuclei are characterized by the fact that, at the end of their range, they suffer radioactive decay ($\tau = 0.9$ sec) into Be^8, which immediately splits up into two oppositely directed α particles, giving what is usually referred to as a hammer track. In this investigation numerous examples have been observed of the emission of such nuclei in stars in photographic emulsions, the stars having from 2 to 60 prongs. In particular, it has been shown that the energy spectrum of the α particles forming the hammer tracks is in good agreement with that observed by other workers, and also with experiments made, using the cloud-chamber technique, indicating that the Be^8 in this disintegration is formed in the excited state. When an electron-sensitive emulsion is used it is shown that the hammer track is accompanied by the Li^8 disintegration electron. The energy spectrum of the Li^8 nuclei is plotted, and the mechanism of the formation is discussed for both large and small stars. (auth)

1286

MEASUREMENT OF MASSES OF COSMIC-RAY PARTICLES. Charles Peyrou and André Lagarrigue. J. phys. radium 11, 666-72(1950) Dec. (In French)

Cosmic-ray experiments are described in which a setup comprising a cloud chamber and Pb filters in a magnetic field was used. The results of the momentum-range measurements are discussed, as applied to determination of the mass of the μ meson and of the presence or absence of mesons of other types. (auth)

1287

ON THE ELECTRON COMPONENT OF THE COSMIC RADIATION. P. Budini. Nuovo cimento 7, 868-80(1950) Oct. 15. (In Italian)

The vertical intensity of cosmic-ray electrons is calculated on the assumption that these electrons are produced from γ quanta, which themselves originate in the decay of neutral π mesons, the latter in turn being generated during nuclear collisions in the upper atmosphere. Approximate numerical results are obtained on the basis of Oppenheimer's multiple production theory, and more accurate ones in the light of the plural production hypothesis.

1288

ON NUCLEAR DISINTEGRATIONS UNDERGROUND. C. Franzinetti. Nuovo cimento (9), 7, 384-7(1950) May 31. (Letter to the editor)

Explosive disintegrations under large thicknesses of matter (about 6000 g/cm^2), recently observed in underground experiments by Evans and George (Nature 164, 20 (1949)), can hardly be attributed to the most penetrating component of the cosmic radiation, viz., the μ mesons, since their interaction with matter is very small. It is perhaps possible to regard those events as nuclear collisions with π mesons, and to look for the source of the latter particles in a Coulomb scattering of π mesons from nucleons by the μ mesons during their passage through the matter. Such a picture is based on the known assumption that the proton and the neutron exist for 1/5 of the time as a neutron plus a positive meson, and a proton plus a negative meson, respectively.

1289

RELATIONSHIP BETWEEN ELECTRON-NUCLEAR AND NARROW SHOWERS OF COSMIC RAYS. S. A. Dubrovina, M. P. Piskov, and I. L. Rozental'. Doklady Akad. Nauk S.S.S.R. 71, 1049-52(1950) Apr. (In Russian)

The nature of narrow atmospheric showers and of the back flux of particles from lead was studied at 3860-m altitude with the aid of a hodoscopic setup surmounted by a star-like group of counters. The density of the back flux was found to be high enough to affect the interpretation of such experiments on narrow showers as those of Alikhanian et al. (Zhur Eksptl'. i Teoret. Fiz. 17, 466(1947)) and of Wei et al. (Phys. Rev. 76, 1488(1949)); as to the origin of the back flux, it seems to be correlated with the generation of "electron-nuclear" showers in lead. The investigation of the narrow showers demonstrated the presence of an electron-photon component and of high-energy electrons. Several events were interpreted as a generation of electron-nuclear showers by narrow showers. This correlation between the latter and nuclear disintegrations has already been observed by other authors (Podgoretskiĭ et al., Doklady Akad. Nauk S.S.S.R. 60, 1527(1948); Gorbunov, Zhur. Eksptl'. i Teoret. Fiz. 19, No. 12 (1949)).

1290

STRUCTURE OF TRACKS GENERATED BY HIGH-ENERGY IONIZING PARTICLES. P. Budini. Nuovo cimento 7, 835-46(1950) Oct. 15. (In Italian)

The structure of ionization tracks produced in various substances (hydrogen and others) by high-energy particles is studied with the aid of the Weizsäcker-Williams method. With growing energy, the ion distribution approaches a limit configuration in which the ion density is represented by b/p^3, p being the distance from the axis of the track, and b the constant integrated photoelectric cross section of the ionized atom. It follows that the number of ions per centimeter of track of a given thickness approaches a limit value when the energy of the ionizing particle increases; if the given track thickness is comparable with that of the nuclear emulsion, the above limit value is very close to that corresponding to the minimum ionization. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1291

THE IONIC CONDUCTIVITY OF Li-HALIDE CRYSTALS. Y. Haven. Rec. trav. chim. 69, 1471-89(1950) Nov.

The ionic conductivity of mixed crystals of Li halides and Mg halides has been measured. From these measurements the mobility of Li vacancies and the concentration of vacancies in pure Li halides have been derived, with the two assumptions that the defects in Li halides are Schottky defects and the mobility of halide vacancies is negligibly small.

ELECTRICAL DISCHARGE

1292

PRELIMINARY NOTE ON THE ENERGY DISTRIBUTION OF ELECTRONS AT THE ANODE OF A LOW PRESSURE DISCHARGE. T. Smith, J. F. Tait, and R. Whiddington. Proc. Leeds Phil. Lit. Soc. Sci. Sect. 5, 207-12(1949) Dec.

The electron energy groups at the anode of a low-pressure hot-cathode glow discharge have been found by magnetic analysis of the electrons passing through the anode. The photographs obtained enable the magnitude and variation with discharge conditions of the anode fall to be found without the disturbing introduction of a probe, and also gave provisional results for the energy distribution in the positive column. Under certain conditions, groups of electrons were produced within the anode-fall region, and their energy variations have been investigated. (auth)

ELECTRONS

1293

Brookhaven National Laboratory
ON RANGE-MOMENTUM MEASUREMENTS FOR ELECTRONS IN GASES. G. F. O'Neill and W. T. Scott. Aug. 31, 1950. 7p. (AECU-1080)

The high-pressure cloud chamber offers a convenient means for determining the range-momentum relations for slow electrons in gases. Gamma rays from Na^{24} produced Compton electrons of momenta up to 1.1 Mev/c, which were investigated in hydrogen and helium at 136 atm pressure and with a regionally calibrated magnetic field of approximately 4000 gauss. The vapor was a water-alcohol mixture. Because of the high-energy loss in the dense gases, the particles were bent into spirals instead of the circles found at low pressure. Each track that can be seen to its end can be used to give a range-momentum relation. The experimental results are compared with the usual energy-loss theory. Even a few tracks give a reasonable confirmation of the theory.

1294

IMPROVED CALCULATIONS ON CASCADE SHOWER THEORY. I. B. Bernstein. Phys. Rev. 80, 995-1005(1950) Dec. 15.

The diffusion equations of cascade shower theory are solved by means of a perturbation method. The first approximation is taken to be that solution obtained by Snyder (Phys. Rev. 76, 1563(1949)) by use of the so-called completely screened cross sections for the elementary processes of bremsstrahlung and pair production. The correction to this is then calculated by use of more refined approximations to the Bethe-Heitler cross sections. The results, which lend themselves to accurate numerical work only in the case of light elements and high incident energies, indicate with respect to Snyder's solution (ibid.) that (1) the shower maximum is decreased in height and slightly shifted to greater depths, and (2) there is a decrease in the average number of electrons present at small absorber depths and a correspondingly larger number at large depths. The magnitude of the correction is larger than had been previously assumed. Numerical results are given so that the correction to the solution under the assumption of completely screened cross sections can be readily calculated for all light elements when the incident particle is either a single photon or a single electron. (auth)

INSTRUMENTS

1295

Brookhaven National Laboratory
SINGLE CRYSTAL NEUTRON MONOCHROMATORS. (ab-

stract) S. Pasternack, A. W. McReynolds, R. J. Weiss, and L. Corliss. Sept. 26, 1950. 1p. (AECU-1074)

The report is reproduced here in its entirety.

The effectiveness of a single-crystal neutron monochromator depends both on the peak reflectivity at the Bragg angle and on the ratio of the rocking curve width to the angular spread permitted by the collimating system (provided that the former is the smaller angle). In connection with designing such a monochromator for a neutron-diffraction apparatus at Brookhaven, some exploratory determinations of these factors were made on several single crystals, using the Oak Ridge neutron-diffraction apparatus. The following results were obtained:

Crystal	Reflecting plane	Peak reflectivity of a thick crystal	Rocking curve width (min)
NaCl	200	0.10	8
Ni	111	0.16	60
Pb	111	0.22	20
Fe	100	0.18	8

For the Brookhaven instrument, whose collimator has a spread of 15 to 20 min, it appears that a lead crystal should yield about five times more intensity than rock salt. Transmission measurements were also made through some of these crystals at and near the Bragg peaks. The relationship of the results to the dynamical theory of x-ray scattering as modified for neutrons by Bacon, Lowde, and Thewlis, and to the theory of inelastic scattering, will be discussed.

1296

MILLION-VOLT BERYLLIUM-WINDOW X-RAY EQUIPMENT FOR BIOPHYSICAL AND BIOCHEMICAL RESEARCH. Wm. T. Ham, Jr., and E. Dale Trout. Radiology 55, 895-6(1950) Dec. (Erratum)

An error in an equation involving all the dosage rates calculated by the water absorption method described in the original paper (Radiology 55, 257-70(1950) Aug.; abstracted as NSA 4-5708) is corrected.

1297

M.I.T. Servomechanisms Laboratory
PRECISION MAGNETIC FIELD REGULATION USING NUCLEAR MAGNETIC RESONANCE; TECHNICAL REPORT NO. 1-6663. Frederick Alan Hadden. Dec. 4, 1950. 193p. (NP-1931)

In this investigation the phenomenon of nuclear magnetic resonance is considered as an element in feedback control systems used to regulate magnetic fields. The need for nuclear magnetic resonance is explained in terms of the more accurate measurement and control it makes available, and the fact that it makes the regulation reference an easily measurable quantity (frequency). The advantages for the control of magnetic-field systems are also due to the availability of suitable error signals, which are a function of the difference between the magnetic field to be measured or controlled and a field proportional to the precisely measured or controlled frequency. An explanation of the phenomenon and its detection is given in terms of quantum mechanics and then in terms of a mechanical model based on Newtonian physics.

1298

TRANSVERSE CONVERGENCE CAUSED BY THE SLITS OF ION-OPTICAL INSTRUMENTS. Francois Bertein. Compt. rend. 231, 766-7(1950) Oct. 16. (In French)

The trajectories of particles in such instruments as the mass spectrometer are generally considered to have two-dimensional optics, i.e., to be perpendicular to the xOz plane. The limited dimensions of the slits parallel to the Oy plane prevent this assumption from being rigorously true; the small "transverse" convergence of the beam toward the xOz plane must be considered. Assuming a slit having the form of a very flat ellipse, the author derives a simple expression for the transverse focal length due to the slit. The relation of this result to the case of exactly rectangular slits is mentioned, and practical application to ion- or electron-optical design is discussed briefly.

1299

WIDE-BAND AMPLIFIER CONNECTED WITH A CATHODE-RAY TUBE FOR OBSERVATIONS OF SHORT EVENTS. P. Schmid and E. Baldinger. Helv. Phys. Acta 23, 478-81 (1950) Sept. 1. (In German)

A circuit for a scintillation counter is described, involving the use of a wide-band amplifier, which is a normal amplifier containing compensating elements for the improvement of the time of rise of the pulse. Photographs show a 5×10^{-8}-sec test pulse and a scintillation pulse produced in anthracene by Co^{60} γ quanta.

ISOTOPES

1300

Argonne National Laboratory
ISOLATION OF MICROGRAM QUANTITIES OF NATURALLY-OCCURRING PLUTONIUM AND EXAMINATION OF ITS ISOTOPIC COMPOSITION. D. F. Peppard, M. H. Studier, M. V. Gergel, G. W. Mason, J. C. Sullivan, and J. F. Mech. Sept. 15, 1950. Decl. Dec. 5, 1950. 12p. (AECD-3016; ANL-WMM-705)

The information in report AECD-2890, which was abstracted in NSA as abstract 4-5888, is presented in greater detail, the former report being in reality a long abstract of the present document.

1301

THE PROBLEM OF ELEMENTS 97 AND 98. A. P. Znoĭko and V. I. Semishin. Doklady Akad. Nauk S.S.S.R. 74, 917-19(1950) Oct. 11. (In Russian)

The discovery of elements 97 and 98 was predicted by Znoiko (Doklady Akad. Nauk S.S.S.R. 69, No. 2, (1949)) on the basis of his periodic table of isotopes, which reveals periodic changes in the properties of isotopes as a function of the ratio Z/A and shows the number of possible isotopes and their radioactive characteristics (Doklady Akad. Nauk S.S.S.R. 68, No. 5, (1949)). Thus, the types of radioactivity

and approximate half-life periods of the newly discovered 97^{243}, 97^{244}, and 98^{244} have been foreseen. It is further predicted that long-lived isotopes 97^{246}, 97^{247}, 97^{248}, 97^{249}, and 98^{250} will also be discovered and will permit an adequate study of those elements' chemical properties. The element 97, which follows "curium," should be named "Mendelevium" (Md).

1302

RADIOACTIVE ISOTOPES OF GALLIUM WITH MASS NUMBERS 66 AND 68. Ambuj Mukerji and Peter Preiswerk. Helv. Phys. Acta 23, 516-17(1950) Sept. 1. (In German)

The decay of Ga^{66} and Ga^{68} obtained from Zn(p,n) was investigated. Ga^{66} is a positron emitter of 68-min half-life and 1.88-Mev maximal spectrum energy, the transition being apparently a permitted one; the spin in the ground state is 1. The spectrum reveals a transition to an excited state at 1.10 Mev, and the corresponding γ ray was observed. The β spectrometer showed the presence of Auger electrons with $H\rho$ = 295, 312, and 321 oersted cm. Ga^{68} is also a positron emitter (9.2-hr; 4.20-Mev max. energy); states corresponding to exciting energies 2.76, 3.3, and 3.81 Mev, as derived from the spectrum, were confirmed by γ-γ coincidence measurements. While a high ft value, together with parity considerations, indicates a doubly forbidden transition to the ground state, the shape of the spectrum is that of a permitted process, a situation similar to that in the β^--decay of P^{32}. No 45-min positron emission, mentioned in the literature and attributed to Ga^{64}, was observed.

ISOTOPE SEPARATION

1303

NEW POSSIBILITIES OF ISOTOPE SEPARATION WITH THE AID OF ION EXCHANGERS. Gerhard Dickel. Z. Elektrochem. 54, 353-7(1950) Aug. (In German)

The author designed two methods for the separation of isotopes in ion-exchange columns which will be published later. He gives here the theory of his methods, which present the following advantages over the pioneer works of Urey (Taylor and Urey, J. Chem. Phys. 6, 429(1938)): in the first of the author's procedures a continuous production of an enriched solution is obtained, while in the second method both a continuous yield and a countercurrent flow of components is realized. The main feature of both procedures is a continuous movement of the adsorbing substance in a direction opposite to that of the solution.

1304

SOME PROPERTIES OF SOLUTIONS OF He^3 IN He^4. I. SEPARATION OF HELIUM ISOTOPES. B. N. Esel'son and B. G. Lazarev. Zhur. Eksptl'. i Teoret. Fiz. 20, 742-7(1950) Aug. (In Russian)

A survey of attempts made in the last three years to separate He isotopes with the aid of thermodiffusion and low-temperature methods shows that it has been impossible to prepare appreciable quantities of sufficiently enriched He^3 in a reasonably short time. A more efficient method, based on the separation of the superfluid He^4 by using the thermomechanical effect, is described here. The use of the latter effect was justified by the demonstration of Landau and Pomeranchuk (Doklady Akad. Nauk S.S.S.R. 59, 669 (1947)) that, even if He^3 possessed superfluid properties, its behavior in a solution must be that of an ordinary substance. The process has two stages: (1) a thermomechanical elimination of superfluid He^4 through a porous mass at 1.5°K, resulting in a He^3 enrichment of about 2000 times, with a 7-day yield of 4.3 liters (room temperature, 760 mm Hg) of a mixture containing about 0.01% He^3, and (2) a further 150-fold enrichment in a rectifying column, yielding 22 cc (room temperature, 760 mm Hg) of a mixture containing 1.5% He^3 in several hours.

1305

SOME PROPERTIES OF SOLUTIONS OF He^3 IN He^4. II. THE SHIFT OF THE λ POINT AND SOME PECULIARITIES OF THE TRANSFER EFFECT. B. N. Esel'son, B. G. Lazarev, and I. M. Lifshits. Zhur. Eksptl'. i Teoret. Fiz. 20, 748-59(1950) Aug. (In Russian)

In Part I (Zhur. Eksptl'. i Teoret. Fiz. 20, 742(1950)) the preparation of 0.03 and 1.5% solutions of He^3 in He^4 was described. The lowering of the temperature of the λ transition in the 1.5% solution was found to be 0.03°. With these solutions, several properties of the transfer effect in the He II film were observed and theoretically explained. (auth)

MASS SPECTROGRAPHY

1306

CONSTRUCTION OF A NEW COMBINED VACUUM FURNACE AND MASS SPECTROMETER FOR UNIVERSAL USE. B. N. Srivastava and V. N. Saharia. Proc. Natl. Inst. Sci. India 16, 263-70(1950) July-Aug.

The design and construction of a new combined vacuum graphite furnace and mass spectrometer have been fully described and its advantages over other mass spectrometers discussed. It is very convenient to handle and is of universal applicability since it can be used to produce with ease ions of all substances and of all types under black-body conditions, and these ions can be separately collected and measured. The apparatus is likely to prove of great utility in a variety of measurements with negative and positive ions. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1307

Brookhaven National Laboratory
THERMAL NEUTRON TIME-OF-FLIGHT VELOCITY SELECTOR. (abstract) F. G. P. Seidl, H. Palevsky, R. F. Randall, and W. Thorne. Dec. 6, 1950. 1p. (AECU-1051)

The report is reproduced here in its entirety.

An instrument similar to the Argonne "chopper" has been put in operation to separate thermal neutrons from the Brookhaven pile according to their times of flight between a

shutter and a detector consisting of one or more $B^{10}F_3$ counters. The associated equipment includes a circuit to introduce a time delay (1 to 16 msec) between the closing of the shutter and actuation of the gating circuits which consecutively open and close 12 recording channels. Means are provided to collimate and monitor the incident beam and for testing the circuits. Special features are: (1) The shutter design prevents the slowest neutrons of one burst from arriving in the detector simultaneously with the fastest neutrons of the following burst. (2) Each recording channel feeds a scaler of high resolution which eliminates dead-time corrections at large counting rates. A time-of-flight resolution, i.e., $(t_{max} - t_{min})t_{av}$, of 5 μ sec/m is available from ~0.2 ev to below 0.001 ev. Slides will be presented [at the 1951 N. Y. APS Meeting] illustrating details of construction and the performance.

1308

Brookhaven National Laboratory
PARTICLE LOCALIZATION BY MEANS OF A SCINTILLATION DETECTOR. Luke C. L. Yuan and H. L. Poss. [nd.] 1p. (AECU-1066)

The report is reproduced here in its entirety.

A long tube with flat ends containing scintillation liquid (Kallman and Furst, Phys. Rev. 79, 857(1950)) was placed between two photomultipliers. Neglecting reflection from the side walls, the intensity of light received at a photomultiplier from a scintillation was proportional to the solid angle subtended by the photocathode at the scintillation point. The ratio of two coincident pulses determined the location of the scintillation along the tube independent of light intensity (particle energy). The pulse ratio was obtained by feeding one pulse to the vertical deflection plates and the other to the horizontal ones of an oscilloscope and measuring the inclination angle of the trace. The trace amplitude was related to the particle energy dissipated in the liquid. Preliminary results on the localization effect were obtained using cosmic rays. The coincidence pulse from a Geiger counter telescope perpendicular to the scintillation detector was used to unblank the oscilloscope. Uncertainty resulting from statistical variations of the photomultipliers was measured by means of a light source placed at various distances between the photomultipliers to simulate scintillations. Possible applications of the localizer to angular correlation and cosmic-ray measurements will be discussed.

1309

AERIAL STUDIES OF ATOMIC DANGERS. Pierre Devaux. Science et vie 78, 395-8(1950) Dec. (In French)

A flying laboratory, consisting of a small monoplane equipped with instruments to study the radioactivity of the upper atmosphere, is described and illustrated. Investigations are being carried out under the supervision of the director of the Puy de Dôme observatory on variations in atmospheric radioactivity with time, in storms, and following atomic explosions.

1310

APPLICATIONS OF NUCLEAR EMULSIONS IN THE MEASUREMENTS OF β-RAY SPECTRA. I. PRELIMINARY RESULTS ON β ACTIVITY OF RUBIDIUM. A. Bonetti. Bull. centre phys. nucl. univ. libre Bruxelles. No. 19, 1-4(1950) May.

The tracks produced in 200-μ Ilford G-5 plates by β rays from a Rb source have been studied in order to test the suitability of nuclear emulsions for β-activity measurements. Preliminary results show that for energies between 20 and 200 kev, the nuclear plate is an adequate tool for the evaluation of the upper limit of β spectra.

1311

CONTINUOUS PROCESS FOR PREPARATION OF SPECIAL PHOTOGRAPHIC EMULSIONS ESPECIALLY SENSITIVE TO TRAJECTORIES OF IONIZING PARTICLES. Pierre Demers. Compt. rend. 231, 616-17(1950) Sept. 25. (In French)

A process in which electron-sensitive photographic film may be produced with high reproducibility by delivering the solutions of $AgNO_3$, KBr, gelatin, etc., with geared pumps is described briefly.

1312

ENERGY LOSSES OF IONIZING PARTICLES AT RELATIVISTIC VELOCITIES IN THE PHOTOGRAPHIC PLATE. H. Messel and D. M. Ritson. Phil. Mag. 41, 1129-32(1950) Nov.

The theory of ionization losses at relativistic velocities in condensed media has been reconsidered, taking exception to previous analyses of data in which the energy losses of particles traversing large thicknesses of matter were considered and the total loss of energy in all collision processes was calculated. Particular importance is given to the actual loss in ionizing the silver bromide grains.

1313

IONIZATIONS AND DISSOCIATIONS PRODUCED BY ELECTRON IMPINGEMENTS IN METHANE, METHANOL, AND METHYLAL. J. Geerk and H. Neuert. Z. Naturforsch. 5a, 502-4(1950) Sept. (In German)

Mass-spectrometric measurements were made of relative quantities of various ions formed during discharges in counters containing vapors of methane, methanol, and methylal, in the electron-energy range 0 to 100 ev. Corresponding critical dissociation potentials were also determined. It was observed that, even in vapors composed of relatively heavy molecules, only ions of medium and small masses were present in notable quantities. (auth)

1314

A NOTE ON THE GEOMETRY OF GEIGER COUNTER TELESCOPES. Homer E. Newell, Jr., and Eleanor C. Pressly. Rev. Sci. Instruments 21, 918-22(1950) Nov.

The contribution of a portion of the solid angle of a two-counter telescope to the total coincidence rate is studied for both isotropic and cosine-squared-law radiation fields. Formulas and graphs are presented for estimating the percentage of counts due to radiation from directions near the telescope axis. The average path length traversed by particles passing through the telescope is touched upon briefly. (auth)

1315

ON PROCESSING NUCLEAR EMULSIONS. PART I. CONCERNING TEMPERATURE DEVELOPMENT. C. C. Dilworth, G. Occhialini, and L. Vermaesen. Bull. centre phys. nucl. univ. libre Bruxelles, No. 13a, 1-18(1950) Feb.

Even development throughout the depth of emulsions up to 1.2 mm in thickness has been attained by the method of temperature development. The principle of the method is based on the difference in activity of the developer at low and high temperatures. The development is divided into 3 stages. The first is the cold stage in which little or no image is formed while the developer penetrates the emulsion. In the second the temperature is raised to allow the formation of the image. Then the development is checked in the third stage simultaneously throughout the depth of the plate by dropping the temperature, and the stop bath is put in. The plate is then ready to be fixed. Development of plates up to 3 mm in thickness should not offer serious difficulty. Applications of thick emulsions to cosmic-ray and nuclear-reaction studies are illustrated, and methods for achieving discrimination are discussed. 17 figures.

1316

ON THE PROPORTIONAL COUNTER. Masateru Sonoda. Mem. Coll. Sci. Univ. Kyoto 25A, 185-92(1949) Dec.

The proportional-counter region of a cylindrical counter is described. In this region the nature of the incident particles can be discriminated by the amount of ionization. Details of the α proportional counter, amplifier circuit, and characteristic curve are presented. Construction, operation, and characteristics of the counter, and of flow-type counters, are included.

1317

PHOTOELECTRIC EXTINCTION CIRCUIT FOR A NON-SELF-QUENCHING GEIGER-MUELLER COUNTER. R. Chaminade, C. Erisson, and A. Lévi. J. phys. radium 11, 1E-2E(1950) Oct. (Letter to the editor; in French)

The advantages of a circuit utilizing the visible and ultraviolet photons emitted at the discharge of the Geiger counter to activate an extinction circuit of constant dead time are presented.

1318

RADIATION MONITORING IN ATOMIC DEFENSE. Dwight E. Gray and John H. Martens. New York, Van Nostrand, 1951. 122p.+ vi.

This book, concerned with the measurement of atomic radiation, is based on the radiological plans and techniques as developed by the Federal Civil Defense Administration and the Atomic Energy Commission and set forth in "The Effects of Atomic Weapons," "United States Civil Defense" (NSRB), and "Civil Defense Radiological Monitoring Instruments Specifications" issued by the Federal Civil Defense Administration. Part I is devoted to background information, presented in a form that can be understood readily by readers with no technical background. It describes the basic concept of atomic energy and radiation, and the kinds of hazards that are produced during and just after an explosion, and those that may continue for some time. It then considers the protective measures that can be taken against atomic explosions and concludes with a detailed study of the detection and measurement of the nuclear radiations. Part II is devoted to the instruments and equipment used in radiation detection. Chapters are given to the Geiger Counter Survey Meter, the Ionization Chamber Survey Meter, the Proportional Alpha Counter, Pocket Chambers and Dosimeters, and Film Badge Dosimeters. The constituents and use of the AEC Emergency Monitoring Kit are described.

1319

A SCINTILLATION SPECTROMETER FOR HIGH-ENERGY GAMMA-RAYS. Sven A. E. Johansson. Nature 166, 794-5 (1950) Nov. 4. (Letter to the editor)

The application of scintillation counters to the measurement of energies exceeding 2 Mev with the aid of photoelectron lines in the pulse-height distribution is attended with some difficulties. A better method is described by which the energy of the electron-positron pairs produced by the γ rays is measured. Collimated γ rays are allowed to impinge on a NaI crystal of a scintillation counter. The crystal is flanked by two other counters placed opposite one another which record the annihilation quanta from the pairs produced in the central crystal. Only coincidences are counted, thus separating pair production from other pulses. The pulse-height distribution is studied with the aid of a discriminator. The apparatus is capable of measuring down to about 1.5 Mev. A pulse-height distribution for Sb^{124} γ rays is given.

1320

SOME PROPERTIES OF DIAMOND USED AS A CRYSTAL COUNTER. H. Ess and J. Rossel. Helv. Phys. Acta 23, 484-7(1950) Sept. 1. (In French)

This work, illustrating certain features of pulses generated in diamond crystals by irradiation with α and γ rays, was a part of an investigation on the motion of electrons in crystals at various temperatures and under conditions excluding effects of polarization and of space charge. The sensitivity of the diamond was found to be different on various points of its surface; it seems that, besides charge captures in the crystal's interior, strong surface effects also take place, a fact observed by Hofstadter (Nucleonics 4, No. 4 and 5(1949)).

1321

THICKNESS GAGING BY RADIATION ABSORPTION METHODS. C. W. Clapp and S. Bernstein. Gen. Elec. Rev. 53 No. 11, 39-42(1950) Nov.

A review of some of the design techniques now applied to gauges which measure thickness by means of absorption of x rays, β rays, or γ rays is presented. Radiation sources, use of β and γ radiation, fluctuating detector signal, safety, detectors (ionization chamber, G-M tube, and phosphor-phototube), and gauging systems (x-ray and β-ray gauges) are discussed.

1322

A TYPE OF GEIGER-MÜLLER COUNTER SUITABLE FOR THE MEASUREMENT OF HIGH ENERGY GAMMA-RAYS. Masateru Sonoda. Mem. Coll. Sci. Univ. Kyoto 25A, 175-83(1949) Dec.

It became necessary to construct a reliable counter which would have a high efficiency for high-energy γ quanta from Li(p,γ) or F(p,γ) reactions and which would not respond to the scattered or secondary rays produced by the surrounding materials. A type of Geiger-Mueller counter with a comparatively thick lead wall was found to be suitable for the purpose. The counting efficiency was calculated theoretically for various energies of γ quanta, since the values are useful essentially for the determination of the absolute cross sections of various photonuclear reactions. Details of the construction, amplifier circuit, gas mixture, characteristic curve, and efficiency are included. 38 references.

MESONS

1323

University of California Radiation Laboratory
THE PRODUCTION OF π^+ MESONS BY PROTONS ON PROTONS IN THE DIRECTION OF THE BEAM. (abstract)
W. F. Cartwright, C. Richman, M. H. Whitehead, and H. A. Wilcox. Nov. 3, 1950. 1p. (UCRL-988)

The report is reproduced here in its entirety.

The first measurements of the cross sections for π^+ meson production by proton-proton collisions showed a large peak in the energy spectrum near the maximum energy of the mesons (Cartwright, Richman, Whitehead, and Wilcox, Phys. Rev. 78, 823(1950); Peterson, Phys. Rev. 79, 407 (1950)). To determine more accurately the spectrum in the region of the peak for mesons produced at 0 deg we have modified our original detection arrangement. By using a new magnet with a larger gap and bending the meson trajectories further away from the proton beam, we have decreased the background due to other particles and obtained better statistics. The proton-beam energy fluctuations were minimized. With these improvements the peak has been investigated in detail. Two reactions may occur: (1) $p + p \rightarrow \pi^+ + d$ and (2) $p + p \rightarrow \pi^+ + n + p$. Mesons produced in (1) in the laboratory system have an energy 4 Mev higher than the maximum energy of those produced in (2). The measured values of the maximum meson energy and the proton beam energy indicate that, if the meson mass is 276 electron masses, deuteron formation does take place. The peak in the spectrum is centered at 70 Mev and has a half width of about 4 Mev.

1324

University of California Radiation Laboratory
LARGE ANGLE FOCUSING OF π^+ AND π^- MESONS.
R. Sagane and Peter C. Giles. Nov. 9, 1950. 1p. (UCRL-1002)

The report is reproduced here in its entirety.

A test has been carried out to focus mesons with the use of the Spiral Orbit Spectrometer principle (2π angular focusing of charged particles originated from the axis with the use of an axial symmetric heterogeneous magnetic field (Miyamoto, Proc. Phys. Math. Soc. Japan 17, 587(1943)). Meson density of more than 10/sec/cm^2 of nearly homogeneous-energy mesons has been obtained so far with 10^{-12} amp of protons at 345 Mev. Nuclear emulsion has been used to detect these focused mesons. Both thick and thin targets made of several different elements were used with and without an axial symmetric Cu tubular absorber. A study of the π^+/π^- ratio of a low (10-Mev) and a high (40-Mev) energy region of mesons from Al, Cu, Ag, Sn, and Pb is now going on. Focusing conditions are quite symmetric for mesons of both signs. Positive and negative mesons coming from opposite directions are stopped in the same portion of a stripped emulsion by using wedge absorbers on each side of the emulsion. An attempt to count the positrons from the decay of μ^+ mesons stopping in the target is being made with the same focusing arrangement.

1325

CORRESPONDENCE PRINCIPLE AND MASSES OF VARITRONS. G. S. Gordadze. Zhur. Eksptl'. i Teoret. Fiz. 20, 767-8(1950) Aug. (Letter to the editor; in Russian)

In applying the correspondence principle to the theory of elementary particles, Born (Nature 163, 207, 320(1949) derived an equation giving the masses of integral-spin particles for values 1, 2, 3, ... of a certain parameter. The masses so calculated are compared here with those of varitrons, as measured by Alikhanov et al. (Doklady Akad. Nauk S.S.S.R. 60, 1515(1948); 61, 35(1948); Zhur. Eksptl'. i Teoret. Fiz. 18, 674(1948)) and by Alikhanian et al. (Zhur. Eksptl'. i Teoret. Fiz. 19, 857(1949)).

1326

ON THE ORIGIN OF SECONDARY SLOW MESONS IN THE ATMOSPHERE. A. Abdullaev, G. Zhdanov, Yu. Kamenetskiĭ, A. Naumov, and A. Khaĭdarov. Zhur. Eksptl'. i Teoret. Fiz. 20, 673-83(1950) Aug. (In Russian)

Delayed-coincidence experiments with a setup described by Zhdanov et al. (Zhur. Eksptl'. i Teoret. Fiz. 19, 273(1949)) led to the following conclusions about the origin of secondary slow μ mesons in the atmosphere. These particles are probably generated in the process of disintegration of some other negatively charged slow component with a half life shorter than 10^{-6} sec and with an ionization range between 5 and 40 g/cm^2; or the process may be of a chain nature, involving several successive products of different masses having a total ionization range within the foregoing limits and interacting strongly (at least the first-born product) with nuclei. (auth)

1327

Purdue University
THE PRODUCTION OF A CHARGED MESON BY AN ELECTRON; TECHNICAL REPORT NO. III; SYNCHROTRON PROJECT. Ellis Strick. June 15, 1950. 42p. (NP-1677)

The cross section for the production of a charged scalar meson by an electron interacting with a proton has been carried out by a third-order perturbation treatment and also by means of the Weizsäcker-Williams impact-parameter method. The cross section for the production of a charged pseudoscalar meson is obtained by the first method (with additional approximations) and is found to be smaller than that of the scalar by a factor of the order of magnitude 3.

METEOROLOGY

1328

METEOROLOGICAL TECHNICS IN AIR POLLUTION SURVEYS. Merril Eisenbud and W. B. Harris. Arch. Ind. Hyg. Occupational Med. 3, 90-97(1951) Jan.

The various meteorological factors influencing air pollution, such as stack height, distance from the stack, wind speed, and atmospheric turbulence are reviewed. A brief discussion is given of the mathematics of turbulent diffusion as covered by Sutton (The Theoretical Distribution of Airborne Pollution from Factory Chimneys, Quart. J. Roy. Meteorol. Soc. 73, 257(1947)), together with average values of the parameters. From this mathematical treatment, the simple equations for estimating maximum ground-level downwind concentration and its distance from the effluent stack also are derived. The authors have conducted air-pollution surveys at various plants and have presented in this discussion a brief résumé of three separate applications demonstrating the value of these equations to the industrial hygienist. (auth)

MOLECULAR PHYSICS

1329

MEASUREMENTS ON THE THERMAL DIFFUSION OF Ne-H_2, Ne-D_2, AND Ne-He MIXTURES AT LIQUID HYDROGEN TEMPERATURES. A. de Troyer, A. van Itterbeek, and G. J. van den Berg. Physica 16, 669-77(1950) Sept.

In order to get more information concerning the attractive forces of the molecules, thermal-diffusion experiments on the mixtures Ne-H_2, Ne-D_2, and Ne-He have been carried out. The degree of separation was determined by means of viscosity measurements. The results show a similar behavior concerning the attractive forces for the mixtures Ne-H_2 and Ne-D_2. The curve of the degree of separation as a function of the logarithm of the ratio of the temperatures used shows for the mixture Ne-He a smaller influence of the attractive forces than for the mixtures mentioned. (auth)

NEUTRONS

1330

University of Wisconsin
ANGULAR DISTRIBUTION OF NEUTRONS FROM Be^9 (p,n)B^9. H. T. Richards, M. J. W. Laubenstein, V. R. Johnson, F. Ajzenberg, and C. P. Browne. [nd.] 1p. (AECU-1044)

The report is reproduced here in its entirety.

Protons from the Wisconsin electrostatic generator, after passing through a cylindrical electrostatic energy analyzer, were used to bombard a thin beryllium foil. Neutrons were detected by a shielded energy-insensitive long counter one meter from the target. The neutron yield has been studied both as a function of angle (0 to 150 deg in the laboratory coordinates) and as a function of proton energy (threshold E_p = 2.059 Mev to E_p = 4 Mev). The neutron yield after conversion to center-of-mass coordinates is isotropic only very close to threshold. In the vicinity of the known resonance at E_p = 2.5 Mev the neutron yield shows maxima at 0 and 135 deg (center of mass coordinates). For $2.75 < E_p < 3.4$ Mev, neutron cross section shows a single maximum at 115 deg. Above 3.4 Mev the yield at 0 and 135 deg increases rapidly as though another resonance is being approached. Absolute cross-section measurements will be reported.

1331

DOUBLE TRANSMISSION AND DEPOLARIZATION OF NEUTRONS. M. Burgy, D. J. Hughes, J. R. Wallace, R. B. Heller, and W. E. Woolf. Phys. Rev. 80, 953-60 (1950) Dec. 15.

Slow neutrons from the chain reacting pile, polarized by passage through highly magnetized iron, have been analyzed by transmission through additional iron (the "double transmission" effect). The large double transmission effects expected from the polarization cross section of iron were obtained only when the magnetic field between polarizer and analyzer was adjusted carefully to obtain nonadiabatic transitions of the neutrons relative to the field. The general methods developed have been used to measure the change in polarization of a neutron beam with passage through unmagnetized iron. The rate of depolarization is a measure of the domain size in the iron, and domain sizes have been measured in this way for a number of Armco iron samples of different metallurgical treatment. (auth)

1332

INFLUENCE OF THE MEAN FREE PATH OF FAST NEUTRONS ON THE DISTRIBUTION OF THERMAL NEUTRONS IN MULTIPLYING MEDIA. S. Gallone and C. Salvetti. Nuovo cimento 7, 901-2(1950) Oct. 15. (Letter to the editor; in Italian)

In former notes (Nuovo cimento 7, 482,626(1950)) a study was made of the distribution of thermal neutrons in a multiplying medium containing a source of fast neutrons. The effect of the mean free path of liberated neutrons on the thermal neutron distribution and on the critical characteristics of the reactor is outlined here for the case when the distribution function of the first collision is of the type $\exp(-kr)/r^2$, r being the distance from the source.

1333

THE RANGE OF CERTAIN FISSION PRODUCTS OF URANIUM IN VARIOUS MATERIALS. Francis Suzor. Dissertation, University of Paris. Paris, Masson et Cie, 1949. 42p. (In French)

This material was published in Ann. phys. 4, 269-309(1949) and was abstracted in Nuclear Science Abstracts as abstract 3-1265.

NUCLEAR PHYSICS

1334

Columbia University
PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH, 1950. J. R. Dunning, Director. June 7, 1950. 32p. (CUD-53)

Activities concerning neutron velocity spectrometer transmission measurements, neutron-scattering experiments,

crystalline samples of iron compounds and stilbene crystals, the variation with solvent type of extractability of As^{76} in the Sziland-Chalmers reaction on dissolved triphenylarsine, instrument development, light-particle investigations, etc., are reported.

1335

NUCLEAR CHEMISTRY (CHIMIE NUCLÉAIRE). R. Renault. Paris, Dunod, 1949. 205p. (In French)

Much the same material as that in a one-school-year course in nuclear chemistry at the senior or graduate level is presented in this volume. The nature of radioactivity, transmutations, artificial radioactivity, properties of the nucleus, and applications of isotopes are discussed in detail. Descriptions of detection instruments, accelerators, and other apparatus are quite sketchy. No problems are included. Few derivations of formulas are given and the use of calculus is kept to a minimum. Certain expressions or conclusions are taken from wave mechanics and nuclear physics. A modification of the Segrè chart is inserted on which the mode of decay of each nuclide is indicated by distinctive coloration.

1336

Chemical Corps School, Army Chemical Center
NUCLEAR PHYSICS. Feb. 1950. 128p. (NP-1910; RDS-3A; NAV PERS 10854)

Nuclear physics is primarily concerned with the core of the atom or nucleus, and the particles of which it is composed. Chapters on the following are included: the atomic nucleus; natural radioactivity; binding energy and nuclear forces; radioactivity and neutron-proton ratio; absorption of alpha, beta, and gamma radiation and neutrons; cosmic rays and ionizing radiations; nuclear particles and gamma radiation; neutrons and neutron reactions; alpha emission and nuclear reactions; decay of multiple radioactivity; nuclear fission and fission products; chain reactions and atomic piles; summary of various types of nuclear reactions.

1337

A POSSIBLE CONTRIBUTION TO THE KNOWLEDGE OF NUCLEAR FORCES. M. Verde. Helv. Phys. Acta 23, 501-3(1950) Sept. 1. (In German)

The scattering of fast neutrons by certain nuclei can be used to distinguish between various proposed models of the nucleus. Thus, if a shell structure is assumed in which nucleons (in the first approximation) move independently in a central field, it can be shown that neutron scattering by nuclei with completed shells only, such as (presumably) C^{12} or O^{16}, should reveal certain resonance levels with strong angular anisotropies and cross-section maxima. Furthermore, if there is a coupling between the nucleons' spin and their orbital moments, the above resonances must occur in pairs (except for the S state). The application of these methods is being carried out in the laboratories of Zurich and Basel; some preliminary results are given by Baldinger et al. (Helv. Phys. Acta 23, 503(1950); NSA abstract 5-1378) and by Ricamo et al. (ibid. 23, 508(1950); NSA abstract 5-1381).

NUCLEAR PROPERTIES

1338

Brookhaven National Laboratory
MASS DIFFERENCE OF RUBIDIUM AND POTASSIUM ISOTOPES. (abstract) E. E. Hays, P. I. Richards, and S. A. Goudsmit. Dec. 5, 1950. 1p. (AECU-1054)

The report is reproduced here in its entirety.

The magnetic time-of-flight mass spectrograph, based on principles described previously (Goudsmit, Phys. Rev. 74, 622-23(1948)) has been assembled. The magnet used is on loan from the Westinghouse Research Laboratories. It was designed several years ago by E. U. Condon and J. A. Hipple and produces a homogeneous field inside a sphere of 19-in. diam. Ions from a pulsed ion source move in a helix of about 12.5-cm radius and 12.5-cm height. An electron-multiplier ion detector was specially designed by L. G. Smith (Rev. Sci. Instruments (in press)). A timer, using the general principles of Loran equipment was built by the Electronics Division of our Laboratory. Up to six revolutions can be measured with accuracy. The total time is about 400 μsec for K, and 850 μsec for Rb. By pulse-matching this can be measured to 0.01 μsec which represents 1 milli-mass-unit. Precision measurements have not yet been possible because of the occurrence of small surface potentials, but it is expected that methods may be developed to correct for their effects. The differences between neighboring masses are not affected by the perturbing electric fields. Preliminary results indicate that the mass difference between Rb^{85} and Rb^{87} is 1.999 and between K^{39} and K^{41} it is 2.000, with an uncertainty slightly over 1 milli-mass-unit.

1339

Brookhaven National Laboratory
THE MASS OF S^{35} FROM MICROWAVE SPECTROSCOPY. (abstract) W. S. Koski, T. Wentink, Jr., and V. W. Cohen. Oct. 2, 1950. 1p. (AECU-1061)

The report is reproduced here in its entirety.

The $J = 1 \rightarrow 2$ rotational transition for OCS has been observed in molecules containing S^{34} and S^{35}. The OCS^{35} frequency is 23457.403 ± .011 mc/sec. From the frequencies and the recently measured frequencies (S. Geschwind, unpublished) of OCS^{33} and OCS^{32}, we have evaluated the isotopic mass difference ratios $\frac{m^{35} - m^{32}}{m^{34} - m^{32}}$ and $\frac{m^{35} - m^{32}}{m^{33} - m^{32}}$, the values being 1.50156 ± 0.00015 and 2.99882 ± 0.00030, respectively. From these and the masses of the stable isotopes the value of m^{35} is calculated to be 34.97898 ± 0.00032, which compares favorably with the value 34.97907 ± 0.00045 as computed from nuclear reaction data (W. Low and C. H. Townes, to be published in the Phys. Rev.). The C−O and C−S bond distances have also been calculated to be 1.1637 and 1.5582 A, respectively.

1340

University of Wisconsin
CAPTURE CROSS SECTIONS FOR FAST NEUTRONS. R. L. Henkel and H. H. Barschall. [nd.] 21p. (AECU-1104)

The fast-neutron capture cross section of Al^{27} was measured by observing the 2.3-min activity of Al^{28} for neutron energies between 10 and 550 kev. Resonances were observed which showed some correlation with scattering resonances so that radiation widths of some of the levels could be estimated. Measurements of activation cross sections were also carried out for F, V, Cu^{65}, Ag, I, In^{115}, and Au. 13 references. (auth)

1341

University of California Radiation Laboratory
A SEARCH FOR EXCITED STATES OF Be^7 USING THE Li^8 TECHNIQUE. George R. Keepin, Jr. Sept. 10, 1950. 18p. (UCRL-924)

At least one excited state in Be^7 is well established at 429 ± 15 kev. The Li^8 technique of neutron-energy measurement has been used to measure $Li^7(p,n)Be^7$ spectra in an extended search for additional levels of Be^7. Spectra were obtained at angles 10, 30, and 90 deg to the proton beam for each of three bombarding proton energies, E_p = 3.00, 3.60, and 4.35 Mev. Although some of the data suggest an additional level in Be^7 intermediate between the known level and the ground state, no single group was considered sufficiently resolved or sufficiently intense to be so identified with certainty. From nine measured spectra comprising approximately 10,000 disintegrations, a mean value of 433 ± 26 kev for the level excitation energy in Be^7 was obtained. (auth)

1342

THE ANGULAR DISTRIBUTIONS OF THE ALPHA PARTICLES AND OF THE GAMMA RAYS FROM THE DISINTEGRATION OF FLUORINE BY PROTONS. C. Y. Chao. Phys. Rev. 80, 1035-42(1950) Dec. 15.

The theoretical angular distributions of the α particles and of the γ rays from the fluorine + proton reactions are given. They are compared with the experimental data, and the following results are obtained: (1) Both angular distributions of the α_1 group and of the α_0 group favor the assumption of even parity of F^{19}. (2) If the parity of F^{19} is taken as even, then (a) the isotropic angular distribution of the γ rays at the resonances of 340 and 669 kev can be interpreted as due to the formation of Ne^{20} compound states of $J = 1^+$ by the capture of s-protons, (b) the slightly anisotropic angular distribution of the γ rays of the resonances of 598, 874, and 1381 kev can be interpreted as due to the formation of Ne^{20} states of $J = 1^+$ by a mixture of s- and d-protons, or of $J = 2^-$ by p-protons, (c) the highly anisotropic distribution of the γ rays observed at 1290 and 1355 kev can be interpreted as due to the formation of Ne^{20} states of $J = 3^+$, and (d) the experimental data of the γ-ray angular distribution and of the ratio $I(\alpha)_{140\ deg}/I(\gamma)_{90\ deg}$ are compatible with the assignment $J' = 3^-$ for the γ_1 level of O^{16}. In general it is possible to make spectroscopic assignments consistent with the experimental data but unique assignments will await further experimental results. (auth)

1343

AN ATOMIC BEAM SOURCE AND SPECTROGRAPH FOR HYPERFINE STRUCTURE. NUCLEAR MOMENTS OF SILVER. M. F. Crawford, A. L. Schawlow, F. M. Kelly, and W. M. Gray. Can. J. Research 28A, 558-73(1950) Nov.

An atomic beam source and a fast spectrograph which have been used effectively in hyperfine-structure investigations are described. The camera objective of the spectrograph is an off-axis paraboloidal mirror. The procedures used to determine the nuclear moments of the two silver isotopes, ($I = 1/2$ for each isotope, $\mu(Ag^{107}) = -0.087$ nuclear moments and $\mu(Ag^{109}) = -0.160$ nuclear moments) are reported. (auth)

1344

EVIDENCE ON PREFERRED NUCLEAR STRUCTURES. G. J. Béné, P. M. Denis, and R. C. Extermann. Helv. Phys. Acta 23, 493-500(1950) Sept. 1. (In French)

Using the latest data on various nuclear properties, curves were constructed bringing out singular points that correspond to certain values of atomic numbers, or proton and neutron numbers, of nuclei. A general conclusion could be reached which divides the known facts among three groups that seem to reflect the different aspects of nuclear structure and stability: (1) "Chemical" properties of the nucleus, i.e., those connected with the periodicity in the latter's structure and due to the influence of the last odd nucleon; they are revealed by the various moments (spin, magnetic, electric quadrupole), by capture cross sections for slow neutrons, and by β-activity probabilities; (2) "Spectroscopic" properties of the nucleus, involving the influence either of the last nucleon alone or of several nucleons, displayed in fission phenomena and in α activities; (3) "Intrinsic" properties of the nucleus as a whole, of which the most important is the mass. This sequence testifies, in the order of decreasing clarity, to the existence of stable structural groups in nuclei.

1345

INFLUENCE OF THE LOCAL FIELD ON THE POSITION OF THE NUCLEAR MAGNETIC RESONANCE. Pierre M. Denis. J. phys. radium 11, 94S-95S(1950) Dec. (Note; in French)

Bloembergen (p.100 of "Nuclear Magnetic Relaxation," The Hague, Martinus Nijhoff, 1948) has pointed out that there might exist a deviation in the nuclear magnetic resonance of protons in solutions of paramagnetic ions, due to the field difference in the sample and in the surrounding parts of the gap between the poles. This hypothesis was tested, in a field of air-core magnets, with a number of paramagnetic ions of various concentrations; the results were negative. On the other hand, a comparison of the resonances of fluorine, as obtained with BeF_2 and SbF_3, revealed the presence of an effect ("beat of beats") that should permit a determination of the ratio between very close transversal relaxation times.

1346

University of Illinois
INTERNAL CONVERSION DATA. P. Axel and R. F. Goodrich. [nd.] 37p. (NP-1921)

Various aspects of internal-conversion theory of interest to the experimental nuclear spectroscopist are presented on 25 graphs. The sources of the theoretical data and a detailed description of the graphs are given in the brief text. Preceding this description is a summary of the in-

direct methods used to determine the spins and parities of nuclear energy levels.

1347

NEW DETERMINATION OF THE RATIO BETWEEN THE NUCLEAR MAGNETIC MOMENTS OF FLUORINE AND THE PROTON. G. J. Béné. J. phys. radium 11, 93S-94S(1950) Dec. (Note; in French)

A test was made of the hypothesis of Stueckelberg (Phys. Rev. 73, 808(1948)), which was based on general-relativity considerations and postulated the existence of a field due to a spin-spin interaction, which may affect the results of measurements of nuclear magnetic moments. Since it could be surmised that such an interaction should exist between measured nuclear moments and the electronic spins in the magnet poles, it was thought that the effect might be detected by using air-core magnets. Preliminary results of the measurement of the ratio between the magnetic moments of F and the proton, when compared with data obtained with the usual method by Mack (Revs. Modern Phys. 22, 64(1950)), showed that the hypothetical spin-spin effect must be smaller than the experimental errors. Other features of the method used were (1) the use of a very low frequency (1.5 Mc) and a weak field (350 gauss for the proton resonance), and (2) the measurement of fields instead of frequencies.

1348

NUCLEAR SPINS OF NEODYMIUM 143 AND 145. B. Bleaney and H. E. D. Scovil. Proc. Phys. Soc. (London) 63A, 1369(1950) Dec. 1. (Letter to the editor)

The spins of Nd^{143} and Nd^{145} have been measured by paramagnetic resonance measurements of neodymium ethyl sulfate diluted with lanthanum ethyl sulfate and found to be 7/2 for both isotopes. The ratio of the magnetic moment of Nd^{143} to that of Nd^{145} is 1.61 ± 0.01. Similar measurements on diluted gadolinium failed to reveal any hyperfine structure.

1349

ON NUCLEAR MAGNETIC MOMENTS. Yu. A. Romanov. Zhur. Eksptl'. i Teoret. Fiz. 20, 577-83(1950) July. (In Russian)

It is shown that a part of the magnetic moment of a nucleus is due to intranuclear, noninertial exchange currents similar to superconductivity currents. (auth)

1350

ON THE SHORT-LIVED METASTABLE STATE OF Hg^{198} INVESTIGATED WITH DELAYED COINCIDENCES. K. P. Meyer, E. Baldinger, and P. Huber. Helv. Phys. Acta 23, 517-21(1950) Sept. 1. (In German)

Using anthracene scintillation counters for both β and γ rays, the lifetime of the 411-kev metastable level of Hg^{198} was measured by the method of delayed $\beta-\gamma$ coincidences. Both delayed and nondelayed quanta were observed, the latter (as shown by an oscillograph) being the more energetic. Both are considered partners of the 0.97-Mev β decay of Au^{198}, and the nondelayed process is that corresponding to the 411-kev transition. The half life of the metastable level, as derived from the coincidence curve, is 3.5×10^{-8} sec. The value found by MacIntyre (Phys. Rev. 76, 312(1949)) is 2.3×10^{-8} sec, while that of Bell and Petch (Phys. Rev. 76, 1409(1949)) is $<3 \times 10^{-9}$ sec. Delayed $\gamma-\gamma$ coincidences, corresponding to a state with the same half life of 3.5×10^{-8} sec, were also observed. Pending further study, the authors abstain from giving a diagram of all the processes involved.

1351

ON SOME REGULARITIES IN THE ISOTOPE EFFECT IN THE SPECTRUM OF LEAD. Kiyoshi Murakawa and Shigeki Suwa. J. Phys. Soc. Japan 5, 382-3(1950) Sept.-Oct. (Short note)

The hyperfine structure of lead, as determined with a Fabry-Pérot interferometer, is presented schematically. Sample interference patterns also are shown. The isotopic-shift ratio $(Pb^{204} - Pb^{206})/(Pb^{205} - Pb^{208})$ was found to be constant within experimental error and to have an upper limit of 0.93, in good agreement with the results of Manning et al. (Phys. Rev. 78, 417(1950)) with isotopically enriched lead. The ratio $(Pb^{206} - Pb^{207})/(Pb^{207} - Pb^{208})$ was also constant to a first approximation and had the mean value 0.615.

1352

PARAMAGNETISM OF ATOMIC NUCLEI STUDIED WITH THE AID OF THE SPIN-MAGNETIC RESONANCE. S. D. Gvozdover and A. A. Magazanik. Zhur. Eksptl'. i Teoret. Fiz. 20, 705-21(1950) Aug. (In Russian)

A solution of the nuclear-induction problem is given in a form of a Volterra-type integral equation. If the parameters of radiosignals obtained during the spin-magnetic resonance are known, it is possible to determine the changes, caused by the nuclear magnetism, that the magnetizing vector undergoes in the course of time. There is a relation between the shape of a radio signal and the amplitude of a high-frequency magnetic field. A new method is shown for the measurement of the duration of the longitudinal relaxation. Special experiments confirmed these theoretical deductions. (auth)

1353

PERIODICITY IN THE MASS-NUMBER TYPES OF THE MOST ABUNDANT ISOTOPES OF ELEMENTS. V. I. Spitsyn. Doklady Akad. Nauk S.S.S.R. 71, 1053-5(1950) Apr. (In Russian)

With increasing mass numbers, elements belonging to each subgroup of the periodic table show certain regularities in changing from one of the four mass-number types (4n, 4n + 1, 4n + 2, 4n + 3) to another. Thus, both subgroups of the first group are characterized by a change 4n + 3 → 4n + 1, those of the second group by 4n → 4n + 2, those of the first subgroup of group III by the successive changes 4n + 3 → 4n + 1 → 4n + 3, those of the second subgroup of group III by 4n + 1 → 4n + 3 → 4n + 1, etc. On the basis of these periodicities predictions can be made, such as that of the existence of more stable isotopes of Fr, e.g., Fr^{225} or Fr^{217}, than the known Fr^{223}. The existence of relatively stable isomers of the known short-lived Tc^{97} and Tc^{101}, as

required by the present theory, is confirmed by recent observations.

1354

PROPERTIES OF STABLE NUCLEI. George J. Béné, Pierre M. Denis, and Richard C. Extermann. J. phys. radium 11, 41D-47D(1950) Oct. (In French)

Tables of gyromagnetic ratios (in general with respect to the proton), spins, nuclear magnetic moments, and electric quadrupole moments of the neutron and elements up to bismuth have been compiled from the literature published up to the end of 1949. A supplement brings the data up to August 15, 1950. 81 references.

1355

STUDIES OF NUCLEAR ENERGY LEVELS WITH FAST NEUTRONS. H. H. Barschall. Am. J. Phys. 18, 535-46 (1950) Dec.

Techniques have been developed for studies of nuclear energy levels, up to energies of about 5 kev, by means of slow neutrons, but the limitation of these techniques to an energy interval of only 5 kev at an excitation energy of the compound nucleus of usually about 8 Mev is a severe disadvantage. The experiments described are essentially an extension to higher energies of the cross-section measurements which had previously been performed with slow neutrons. The theory of nuclear resonances, experimental methods, results of total-cross-section measurements and of absorption measurements are covered. 22 references.

NUCLEAR REACTORS

1356

Knolls Atomic Power Laboratory
MATHEMATICAL METHODS IN PILE CALCULATIONS. H. Hurwitz, Jr. Nov. 10, 1950. Decl. Dec. 4, 1950. 8p. (AECD-3019)

Brief explanations of some of the theoretical calculation methods used for computing properties of assemblies of fissionable material are given. Greater attention is paid to those methods the author has had occasion to use. Assumptions justifiable for various piles are discussed briefly.

1357

Atomic Energy Project (Canada)
CRITICAL RADIUS OF A MULTIPLYING SPHERICAL CORE SURROUNDED BY A NON-MULTIPLYING REFLECTOR OF FINITE THICKNESS. G. Volkoff. Apr. 15, 1944. 5p. (CRT-393)

The modifications introduced into calculations of the critical radius of a multiplying spherical core surrounded by an infinite, nonmultiplying reflector of the same scattering properties by taking the reflector to be of finite thickness compared to the diffusion length of thermal neutrons in the reflector, but still large compared to the slowing-down length, have been derived.

NUCLEAR TRANSFORMATION

1358

University of Wisconsin
ENERGY LEVELS OF Si^{28} EXCITED BY ALPHAS ON Mg^{24}. S. G. Kaufmann, F. P. Mooring, L. J. Koester, and E. Goldberg. [nd.] 1p. (AECU-1042)

The report is reproduced here in its entirety.

Energy levels of Si^{28} have been studied at this laboratory by means of the bombardment of Al^{27} by protons (Bender et al., Phys. Rev. 76, 273(1949), Shoemaker et al. (to be published)). When analysis of the results proved ambiguous, it was thought that alphas on Mg^{24} would offer a simpler approach to the problem. Alpha particles produced by the Wisconsin electrostatic generator were used to bombard thin $Mg^{24}F_2$ targets evaporated onto spectroscopically pure graphite backings. The reaction products separated by a 90-deg magnetic analyzer were observed at a laboratory angle of 164 ± 5 deg. Excitation curves for the reaction $Mg^{24}(\alpha,\alpha)Mg^{24}$ and $Mg^{24}(\alpha,p)Al^{27}$ have been obtained. The $Mg^{24}(\alpha,p)Al^{27}$ and the $Al^{27}(p,\alpha)Mg^{24}$ yield curves show an excellent correspondence in structure. A preliminary Q value of −1.62 Mev for the reaction $Mg^{24}(\alpha,p)Al^{27}$ has been obtained.

1359

EMISSION OF NEUTRONS AND PROTONS FROM Ne^{22} BY THE BOMBARDMENT OF α PARTICLES. Z. M. I. Oliano and R. R. Roy. Bull. centre phys. nucl. univ. libre Bruxelles, No. 23, 1-5(1950) Dec.

The reactions $Ne^{22}(\alpha,n)Mg^{25}$ and $Ne^{22}(\alpha,p)Na^{25}$ were investigated by the photographic technique method. Two groups of neutrons were observed corresponding to Q values of -0.916 ± 0.07 and -1.71 ± 0.08 Mev for $E_\alpha = 4.4$ Mev (polonium source). A study of the reaction $Ne^{22}(\alpha,p)Na^{25}$ was made by the detection of β particles according to the process $Na^{25} \xrightarrow{\beta} Mg^{25}$, the incident energy of the α particles being 4.8 Mev.

1360

FAST-NEUTRON REACTION $B^{10}(n,\alpha)Li^7$ AND THE REACTION ENERGY OF THE PROCESS $D(d,n)He^3$. A. Stebler, H. Bichsel, and P. Huber. Helv. Phys. Acta 23, 511-13(1950) Sept. 1. (In German)

The reaction $B^{10}(n,\alpha)Li^7$, involving fast neutrons from $D(d,n)He^3$, was observed in an ionization chamber filled with $A + BF_3$, the effect of thermal neutrons being reduced with the aid of a 1-cm-thick amorphous-boron envelope. The α-particle energy spectrum showed, besides a maximum at 2.23 Mev reflecting the reaction produced by thermal (a few electron volts) neutrons, (1) two pairs of maxima representing entrance resonances of scattered fast neutrons in reactions that end, respectively, in Li^{7*} and Li^7, and (2) two maxima at 5.15 and 5.67 Mev corresponding to these two reactions as produced by monochromatic fast neutrons from the (d,d) process. Energies corresponding to the latter two resonances are 1.81 ± 0.04 and 2.03 ± 0.04 Mev. The ratio $\sigma(Li^7)/\sigma(Li^{7*})$ between cross sections for reactions ending in the two states depends on the neutron energy; while it is 0.08 for thermal neutrons, for 3-Mev neutrons it is equal to 2.0 ± 0.3. From the foregoing

spectrum the neutron energy can be read off as the difference between maxima corresponding to fast and slow neutrons; knowing this and the D energy, the reaction energy of the process $D(d,n)He^3$ can be deduced; it is $Q = 3.23 \pm 0.04$ Mev, in accordance with Tollestrup et al. (Bull. Am. Phys. Soc. 24, No. 4, 29(1949)).

1361

A NOTE ON THE ANGULAR DISTRIBUTION OF PAIR-ELECTRONS OF 17-MEV γ RAYS. Sakae Shimizu and Jiro Muto. Mem. Coll. Sci. Univ. Kyoto 25A, 61-2(1949) Oct.

The results of cloud-chamber observation of photo-α-particles expelled from a lead plate under the irradiation of 17-Mev γ rays of $Li(p,\gamma)$ reactions were previously reported. (Arakatsu et al., J. Phys. Soc. Japan 1, 24(1946)). On the photographic films taken in that experiment, the angular distribution of partners of the pairs with respect to the incident photons have been measured. A brief note on the results obtained is presented.

1362

ON THE ENERGY DEPENDENCE OF THE PROCESSES $S^{32}(n,p)P^{32}$ AND $P^{31}(n,p)Si^{31}$. E. Lüscher, R. Ricamo, P. Scherrer, and W. Zünti. Helv. Phys. Acta 23, 561-6(1950) Sept. 1. (In German)

Resonances in the reaction $S^{32}(n,p)P^{32}$ observed by Bleuler (Helv. Phys. Acta 20, 519(1947)) are definitely confirmed. While similar phenomena occur also in $P^{31}(n,p)Si^{31}$, they are not found in $Cl^{35}(n,\alpha)P^{32}$. (auth)

1363

ON THE INTERACTION OF γ RAYS WITH THE DEUTERON. G. M. Avak'yants. Zhur. Eksptl'. i Teoret. Fiz. 20, 669-72 (1950) July. (In Russian)

Taking into account the charge exchange between the proton and the neutron, a computation is made of the effective cross section for the disintegration of a deuteron by γ rays. It is shown that the cross section is strongly affected by the charge exchange. (auth)

1364

ON A REACTION $Fe(n,\alpha)$ INVOLVING SLOW NEUTRONS. H. Hänni and J. Rossel. Helv. Phys. Acta 23, 513-16(1950) Sept. 1. (In French)

The reactions $Fe^{58}(n,\alpha)Cr^{55}$ and $Fe^{54}(n,\alpha)Cr^{51}$ were anticipated in experiments with Ilford E_1 and D_1 100-μ emulsions containing Fe saccharosate (7.6×10^{18} Fe nuclei/cm^2) and irradiated with slow neutrons, Cd-filtered. Statistics of α-track lengths revealed two maxima corresponding to values $Q = 6.0$ and 4.9 Mev, which point to the process $Fe^{58}(n,\alpha)$ ending in both the ground and the excited state of Cr^{55}; or, if only one broad maximum exists, the corresponding value of Q is 5.5 ± 0.4 Mev, which is close to those given by Bethe (5.42 Mev) and by Rosenfeld (5.75 Mev) for the same reaction. The neutron flux was measured by Li-charged emulsions juxtaposed to the Fe-impregnated emulsions. The resulting value of the cross section for the reaction is $(4 \pm 2) \times 10^{-28}$ cm^2.

1365

PHOTO-INDUCED REACTION $Cu^{63}(\gamma,n)Cu^{62}$ PRODUCED BY THE GAMMA-RAYS OF LITHIUM BOMBARDED WITH HIGH SPEED PROTONS. Sakae Shimizu. Mem. Coll. Sci. Univ. Kyoto 25A, 193-208(1949) Dec.

$Cu^{63}(\gamma,n)Cu^{62}$ reaction produced by the γ rays emitted from Li bombarded with 460-kev protons were observed, and a fairly accurate value of the cross section for this reaction was determined by measurement of the induced positron activities produced in Cu samples as against the total number of irradiating γ-ray quanta. In order to eliminate the effect of self-absorption of positrons of Cu^{62} in the samples, the ratio of activities of the samples to those of a monitor sample was plotted as a function of thickness of the samples. From this curve a value could be extrapolated which did not suffer from the effect of self-absorption. Total number of γ-ray quanta concerned was measured with a Geiger-Mueller counter of thick Pb wall whose counting efficiency was computed theoretically. After measurements of the decay constant of Cu^{62} and of various factors concerning the geometrical arrangement and analysis of the experimental data, the cross section of $Cu^{63}(\gamma,n)Cu^{62}$ for 17.6 Mev $h\nu$ was obtained as $7.7_5 \times 10^{-28}$ cm$^2 \pm 15\%$, which, however, was increased to 8.5×10^{-28} cm$^2 \pm 15\%$ by taking into account the fact that the Li γ rays have a line at 14.8 Mev besides a line at 17.6 Mev. A discussion of the values obtained by other workers is also given. (auth)

1366

URANIUM FISSION CROSS SECTION MEASUREMENT FOR THERMAL NEUTRONS. U. Facchini and E. Gatti. Helv. Phys. Acta 23, 556-60(1950) Sept. 1.

A similar paper on the same subject was published by the authors in Nuovo cimento 7, 589(1950), abstracted in NSA as abstract 4-6673.

PARTICLE ACCELERATORS

1367

THE BEVATRON. Lloyd Smith. Sci. Am. 184, No. 2, 20-25(1950) Feb.

This article describes the proton synchrotron, in particular the one called the Bevatron (for billion electron volts) now under construction at the University of California. When finally completed it will have a magnet of 10,000 tons, and the ring-shaped chamber, or doughnut, will be 110 ft in diameter. It will be housed in a circular structure 215 ft in diameter, with an attached rectangular section housing electrical and other equipment. A linear accelerator will feed protons at about 10 Mev into the Bevatron itself.

RADIATION ABSORPTION AND SCATTERING

1368

University of Wisconsin Case Institute of Technology
THE SCATTERING OF GAMMA RAYS BY NUCLEONS. R. G. Sachs and L. L. Foldy. [nd.] 33p. (AECU-1010)

In order to explore the possibility that information concerning nucleon structure could be obtained from the scattering of photons of energy near meson-production threshold, the cross section for the process has been calculated on the basis of the symmetrical scalar and pseudoscalar meson theories. The calculation was carried out in the nonrelativistic, weak-coupling approximation, neglecting nucleon recoil effects. No divergence difficulties were encountered. In the scalar theory, the proton total cross section is somewhat less than the Thompson cross section (σ_0) as a consequence of interference between the scattering by the nucleon and that by the meson cloud. In pseudoscalar theory the total cross section varies strongly with energy, showing a resonance scattering effect with a peak value as high as 15 σ_0. The angular distribution in the scalar theory is very similar to that given by the Klein-Nishina formula: $\frac{1}{2}(1 + \cos^2\theta)$. The pseudoscalar theory gives a quite asymmetric distribution, the form of asymmetry depending strongly on energy. The results may be taken as a strong indication that observation of the process could yield, in a sensitive way, information concerning the structure of the proton. (auth)

1369

Los Alamos Scientific Laboratory
NEUTRON-PROTON SCATTERING AT 27 MEV.
J. E. Brolley, Jr., J. H. Coon, and J. L. Fowler. [nd.] 19p. (AECU-1030; LADC-768)

Monoenergetic neutrons of energy 27.2 Mev were produced by 10-Mev deuterons incident on a gaseous tritium target. Protons recoiling from the neutrons were observed in a four-fold coincidence proportional counter telescope. The angular distribution of neutrons scattered through angles in the range from 180 to 76 deg in the center-of-mass system was measured. The observed ratio of scattering at 180 to that at 90 deg was 1.28 ± 0.10. (auth)

1370

Brookhaven National Laboratory
COHERENT NEUTRON SCATTERING FROM GASES. (abstract)
A. W. McReynolds and G. W. Johnson. Dec. 7, 1950. 1p. (AECU-1049)

The report is reproduced here in its entirety.

Neutron coherent scattering lengths for gases have been determined by measurement of the index of refraction using a total reflection method. Well-collimated neutron beams from the Oak Ridge and Brookhaven reactors were reflected from surfaces of aluminum, lucite, and ethylene glycols at angles of 1 to 5 min. Pressures of surrounding O_2, N_2, He, or A were varied from 1 to 150 atm, and neutron indices of refraction of the gases relative to the mirror and to each other determined from variation of reflected intensity with pressure. The results for oxygen were in good enough agreement with the value 4.2 barns from diffraction measurements on solid oxides to verify that the same cross section is derived from refraction in gases, although atomic binding differs. The cross section of nitrogen was found to be about 10 barns, compared to 4.6 barns (coherent) from diffraction results. Phase of scattering was positive for all four gases.

1371 AECU-1052

Brookhaven National Laboratory
INELASTIC SCATTERING OF LOW ENERGY NEUTRONS IN GRAPHITE. (abstract) G. W. Johnson, H. Palevsky, and D. J. Hughes. Dec. 7, 1950. 1p. (AECU-1052)

The report is reproduced here in its entirety.

The velocity selector described in the preceding abstract was used to measure the inelastic cross section in graphite. The measurements were made with wavelengths longer than the Bragg cutoff (6.7 A) to avoid coherent scattering. Graphite is suited for checking the existing inelastic scattering theories as it exhibits no spin-dependent scattering and the isotopic incoherence is negligible. In addition the correction for neutron capture is small. For room-temperature graphite the cross section was measured as 0.8 barn at 7 A. In the range 7 to 11 A the cross section was proportional to wavelength. The room temperature value, as well as the wavelength dependence of the cross section, is in agreement with the theory of J. Pomeranchuk and A. Akhieser (Zhur. Eksptl'. i Teoret. Fiz. 17, 770(1947)) and D. Kleinman (Chicago Phys. Soc. Meeting, Nov. 1950, Paper V8). The temperature dependence of the cross section is now under investigation.

1372

Brookhaven National Laboratory
INELASTIC SCATTERING OF THERMAL NEUTRONS. (abstract) David A. Kleinman. [nd.] 1p. (AECU-1065)

The report is reproduced here in its entirety.

The one-phonon cross sections, often principally responsible for the inelastic scattering, were calculated for a number of materials as a function of the incident-neutron energy E for several crystal temperatures T. To shorten the calculations the integrals, equivalent to those given by Weinstock, were evaluated graphically on specially ruled paper. This method is still laborious owing to the large number of integrals, so the method of integrating over reciprocal lattice points was developed following a suggestion by Pomeranchuk and Akhieser. This leads to the formula

$$\sigma = \sigma_0 \frac{m}{M} \frac{E}{\theta} \left[F\left(\frac{E}{\theta}, \frac{T}{\theta}\right) - rf(r) G\left(\frac{E}{\theta}, \frac{T}{\theta}\right) \right]$$

where $r = (m/M)(E/\theta)\phi(T/\theta)$ is essentially the Debye-Waller temperature exponent. Tables have been prepared of $F(E/\theta, T/\theta)$ and $G(E/\theta, T/\theta)$ as well as $\phi(T/\theta)$ and $f(r)$, permitting rapid calculation of the one-phonon cross section. The validity of the reciprocal-lattice integration requires sufficient incident energy to involve a large number of crystal planes in the scattering process, but fortunately the tables agree quite well with the more laborious calculation even at the lowest energies.

1373

Brookhaven National Laboratory
SMALL ANGLE SCATTERING OF THERMAL NEUTRONS (EXPERIMENTAL). (abstract) A. W. McReynolds and R. J. Weiss. Sept. 25, 1950. 1p. (AECU-1070)

The report is reproduced here in its entirety.

Broadening of a neutron beam by small-angle scattering in transmission through finely divided materials was studied

as a function of neutron wavelength and number, size, and index of refraction of particles. Dependence on these parameters confirmed theoretical considerations. A well-collimated beam was reflected from a mirror adjusted to the critical angle of 3-A neutrons and allowed to traverse the powder samples. The beam contour was plotted with a slit mounted on a comparator before a BF_3 proportional counter. By immersing the sample in a liquid of known index of refraction the phase of slow-neutron scattering and the coherent cross section could be determined. The phases of P, Si, Cr, Se, Ru, Mo, Pd, Nb, Bi, and Te were found to be positive. The coherent cross sections of Cr and Si indicated little isotopic or spin incoherence. Small-angle scattering from carbon blacks yielded results agreeing with x-ray scattering and showed the scattered central maximum superimposed on the undeviated beam. Quantitative agreement with the total cross section for small-angle scattering per particle was obtained and substantiated the R^4 dependence. The small-angle scattering by ferromagnets discovered by Hughes was corroborated.

1374

Brookhaven National Laboratory
THE SCATTERING OF LIGHT BY LIGHT. Robert Karplus and Maurice Neuman. Aug. 31, 1950. 32p. (AECU-1079)

Cross sections for several processes involving electromagnetic fields in a nonlinear manner are derived from the electrodynamic scattering matrix and are expressed in terms of the fourth-order nonlinear vacuum polarization tensor. The differential cross section for the scattering of light by light is calculated as a function of energy and angle. Numerical values are given for scattering at 0 and at 90 deg in the center-of-mass system. Near 1.75 Mev the forward scattering cross section has its largest value of 4.1×10^{-31} cm^2 sterad, while the maximum right-angle scattering takes place near 0.7 Mev with a cross section of 2.8×10^{-31} cm^2 sterad, all for unpolarized radiation. Numerical results are also given for scattering at the foregoing angles between circularly polarized states. The conclusions in this paper agree with all the results previously calculated for special cases. (auth)

1375

Iowa State College Ames Laboratory
ON THE IONIZATION YIELDS OF FISSION FRAGMENTS. R. B. Leachman. [nd.] 19p. (ISC-98)

Disagreement between the distribution in fission fragment mass and ionization is attributed to a possible variation in ionization yield with fragment mass and to a dispersion arising from such effects as neutron recoil and instrumental errors of ionization measurement. A method is developed for first accounting for the effects of the dispersion and then estimating the variation of ionization yield by the remaining disagreement in distributions. This method is used with the available data of fragments from U^{235} slow-neutron fission to obtain the relative ionization yields of complementary light and heavy fragments and the variation of this relative yield with fission asymmetry. For the most probable fission asymmetry, the energy/ionization ratio of light fragments is found to be approximately 3.7% less than for heavy fragments. The results indicate that the dispersion accounts for an appreciable part of the observed distributions in total ionization only for fission of large asymmetry. (auth)

1376

University of California Radiation Laboratory
ANGULAR DISTRIBUTION OF GAMMAS IN SHOWERS. (abstract) Jack W. Rose. Nov. 8, 1950. 1p. (UCRL-995)

The report is reproduced here in its entirety.

A study has been made of the angular distribution of γ's in showers initiated in Pb and Cu by the 335-Mev bremsstrahlung of the Berkeley synchrotron. The x-ray beam, collimated to ¼ in., passed normally through a thin monitor foil and then through plates of Pb or Cu. The shower γ's emerging from the far side of the plates were detected by means of the radioactivity of Cu foils, utilizing the reaction $Cu^{63}(\gamma,n)Cu^{62}$. The activities induced in the foils at various angles with the beam were compared to that in the monitor foil by means of G-M counters. Since the (γ, n) reaction utilized is believed to have a narrow excitation curve peaked at about 20 Mev (Baldwin and Klaiber, Phys. Rev. 73, 1156 (1948)), the angular distribution curves obtained should essentially be those for 20-Mev γ rays. The preliminary results agree reasonably well with calculations of the lateral structure of showers to be published by L. Eyges and S. Fernbach.

1377

University of California Radiation Laboratory
PROTONS SCATTERED OUT OF NUCLEI AT HIGH ENERGIES. (abstract) J. B. Cladis, J. W. Hadley, and B. J. Moyer. Nov. 8, 1950. 1p. (UCRL-999)

The report is reproduced here in its entirety.

Proton energy spectra are obtained by deflecting scattered protons by a magnetic field into channels defined by proportional counters and a bank of 35 Geiger counters. With incident protons of 340 Mev, the scattered protons from light elements viewed at 22 deg have spectra resembling free-particle scattering: the peaks fall at nearly the same energy, the deuterium yield is about twice the hydrogen yield, and the carbon points multiplied by 16/12 give a curve which is indistinguishable from that of oxygen. With incident neutrons of 270 Mev on deuterium, scattered proton yields in the forward direction are suppressed relative to corresponding yields from hydrogen. This is in keeping with predictions based on exclusion-principle requirements pertaining to the two neutrons which now possess a small relative momentum.

1378

ANGULAR DISTRIBUTION OF NEUTRONS ELASTICALLY SCATTERED BY OXYGEN, CARBON, AND NITROGEN. E. Baldinger, P. Huber, R. Ricamo, and W. Zünti. Helv. Phys. Acta 23, 503-7(1950) Sept. 1. (In German)

In connection with Verde's views (Helv. Phys. Acta 23, 501 (1950); NSA 5-1337) on anisotropies to be expected in fast-neutron scattering, measurements were made of recoil-energy distributions in collisions of (d,d) neutrons of given energy with O, C, or N in an ionization chamber. Such

energy spectra reflect the angular distribution of the neutron scattering; they were found to present maximum and minimum ordinates, and the ratio maximum/minimum was taken as a measure of the scattering anisotropy for a given neutron energy. The curve of anisotropy/neutron energy which was then plotted revealed resonance levels characteristic of the substances investigated.

1379

BETA-RAY TRAJECTORIES IN INHOMOGENEOUS MAGNETIC FIELDS. J. Lafoucrière. J. phys. radium 11, 92S-93S(1950) Dec. (Note; in French)

A classification of magnetic fields used in measurements of β spectra is outlined, with special emphasis on fields with decreasing rH (r is the radius vector); cases of aperiodic, asymptotic, and periodic trajectories are considered.

1380

CHEMICAL BONDS OF PROTONS MEASURED WITH A VELOCITY SELECTOR FOR SLOW NEUTRONS. R. Keller. Helv. Phys. Acta 23, 522(1950) Sept. 1. (In French)

The report is reproduced here in its entirety.

With the aid of a velocity selector, neutrons of 0.003- to 1-ev energy were obtained and used for the determination of the scattering cross section, as a function of energy, of hydrogen in the following compounds; $(COOH)_2$, HCOONa, HCOOH, $CuSO_4 + 5H_2O$, and H_2O. The extrapolation of the curves toward high energies permitted conclusions on the nature of the chemical bond of H in each particular case. A detailed report will be published.

1381

EXPERIMENTS ON FAST-NEUTRON SCATTERING BY CARBON AND OXYGEN. R. Ricamo, W. Zünti, E. Baldinger, and P. Huber. Helv. Phys. Acta 23, 508-10(1950) Sept. 1. (In German)

Verde (Helv. Phys. Acta 23, 501(1950); NSA 5-1337) has shown how elastic scattering of fast neutrons by saturated nuclei, such as C and O, can be used as a test of the existence of a central field and of couplings between spins and orbital moments in nuclei. The authors have reported elsewhere (Baldinger et al., Helv. Phys. Acta 23, 503(1950); NSA 5-1378) on hitherto unknown resonance levels in the range 2.5 to 3.9 Mev, where strong scattering anisotropies take place. In the present paper, preliminary results are given of a study on the neutron-energy dependence of the scattering cross section of C and O, the latter being determined from measurements of the weakening of neutron beams when traversing screens of graphite and SiO_2. The spectra obtained present distinct resonance levels.

1382

SCATTERING OF (d,d) NEUTRONS BY DEUTERONS AND PROTONS. J. Halter, I. Hamouda, and P. Scherrer. Helv. Phys. Acta 23, 510-11(1950) Sept. 1. (In German)

This report is a preliminary summary of a work to be published shortly on the scattering of 3.27-Mev neutrons by deuterons, as observed in a cloud chamber. For the estimation and elimination of effects caused by diffusion neutrons, parallel measurements of the neutron scattering by protons were made. The general result is an angular distribution curve whose shape may permit a discrimination between different meson theories of nuclear forces.

1383

THE SCATTERING OF GAMMA-RAYS IN EXTENDED MEDIA. I. PERPENDICULAR INCIDENCE ON A PLANE SLAB. L. Cave, J. Corner, and R. H. A. Liston. Proc. Roy. Soc. (London) 204A, 223-59(1950) Dec. 7.

As the simplest problem involving the multiple scattering of γ rays, the case of perpendicular incidence on a plane slab has been studied by various simple theoretical methods. No exact solution is available as a test of these methods, but approximations of increasing accuracy, known to give too small a dose under the slab, have been combined with a theoretical upper limit for the dose, forming a zone in which the exact solution must lie. Most of the methods tested could be used even if pair creation or the photoelectric effect gave an appreciable absorption, although for simplicity the computations have been carried out for pure Compton scattering and for quantum energies of a few Mev. Polarization by the Compton effect has been neglected. The best of the simple methods is a modification of the upper limit solution; in problems where this is too difficult to formulate, a good alternative is to calculate the dose from unscattered and once-scattered quanta, giving the latter the penetrating power of the incident quanta and the maximum possible energy-absorption cross section. (auth)

1384

SOME PROPERTIES OF THE RADIATION PRODUCED BY FAST PARTICLES MOVING IN A MAGNETIC FIELD. Bernard Kwal. J. phys. radium 11, 685-90(1950) Dec. (In French)

Following Artsimovich and Pomeranchuk (J. Phys. U.S.S.R. 9, 267(1945)), a definition is derived of "principal" photons which carry the bulk of the energy radiated by a very fast charged particle moving in a magnetic field. The number of principal photons generated per unit length of path is independent of the particle's energy and is proportional to the intensity of the field. A study is made of the spectrum of principal photons generated in a betatron and in the field of a magnetic dipole, both for the case of a particle approaching the center of the dipole and for that of a receding particle. After a brief discussion concerning the energy loss in the case of closed orbits, the formulas are applied to several simple problems related to the movement of electrons, mesons, and protons in the magnetic fields of the earth and the sun. (auth)

1385

WORK PER ION PAIR PRODUCED BY α PARTICLES IN GAS MIXTURES. W. Haeberli, P. Huber, and E. Baldinger. Helv. Phys. Acta 23, 481-4(1950) Sept. 1. (In German)

Energy required for the formation of an ion pair by U α particles in mixtures of N_2, O_2, He, and A was determined by measuring the saturation charge with the aid of an amplifier and a pulse spectrograph (Maeder, Helv. Phys. Acta 20, 139(1947)). It was found that a formula based on the assumption of an independent behavior of mixture components is only approximately true; electrons and light quanta may be held responsible for the interaction involved.

1386

THE X-RAY SCATTERING FROM A HINDERED ROTATOR. Murray Vernon King and William N. Lipscomb. Acta Cryst. 3, 155-9(1950) Mar.

An expression is derived for the x-ray scattering from a crystal containing groups of atoms in hindered rotation about fixed axes. A Maxwell-Boltzmann distribution of the orientation angles of the groups is assumed, with a sinusoidally varying hindering potential. Although a corresponding expression is not derived for the hindered rotator without a fixed axis, it is shown that structure-factor data in the particular case of perfluorocyclohexane lead to the conclusion that the molecule is not a free rotator in the crystal, but either may be a hindered rotator or may show orientational disorder. (auth)

RADIATION EFFECTS

1387

EFFECT OF NEUTRON IRRADIATION ON THE THERMAL CONDUCTIVITY OF A QUARTZ CRYSTAL AT LOW TEMPERATURE. R. Berman, P. G. Klemens, and F. E. Simon. Nature 166, 864-6(1950) Nov. 18. (Letter to the editor)

Lattice defects, consisting of displaced atoms, have been produced in a quartz crystal by irradiation with fast neutrons in a pile, and the changes in conductivity after several successive periods of irradiation and after subsequent annealing have been measured. The extra thermal resistance is due to these displaced atoms and is not associated with any nuclear transformations which may be produced in small quantities during the irradiation. The temperature range of the measurements, 2 to 90°K, is covered more fully than has been done before in heat conductivity measurements. With increasing irradiation, there is a gradual transition in the form of the temperature dependence of conductivity from that of the original crystal to that of the glass. An interpretation of this observation is made in terms of the theory of thermal conductivity of crystals and glasses.

RADIOACTIVITY

1388

Brookhaven National Laboratory
GAMMA-RAYS IN THE DECAY OF Rh^{106} AND Pr^{144}. (abstract) D. E. Alburger, E. der Mateosian, M. Goldhaber, and S. Katcoff. Dec. 5, 1950. 1p. (AECU-1050)

The report is reproduced here in its entirety.

Among long-lived fission products, 1-yr Ru^{106} and 275-day Ce^{144} have been found to produce photoneutrons in Be and D. The photoneutrons are produced by γ rays emitted with intensities of the order of 2% per β ray in the decay of the daughters, 30-sec Rh^{106} and 17-min Pr^{144}. In Rh^{106} a 2.9-Mev γ ray was found with a scintillation spectrometer. The whole γ-ray spectrum has been investigated in detail with a lens spectrometer and found to consist of lines with energies of 0.511, 0.621, 0.87, 1.045, 1.55, and 2.9 Mev. The first two are strong and of nearly equal intensity and agree with internal-conversion lines found by R. D. Hill. No crossover γ ray of 511 + 621 kev is observed. It is probable that more than one pair of cascade γ rays is present and this may play a role in the analysis of the angular correlation known to exist for Rh^{106}. The γ-ray spectrum of Pr^{144} has at least three components, 2.185 ± 0.015, 0.700 Mev, and a line of less than 150 kev. The first of these was measured by a direct comparison with the 2.2-Mev line from radium. The weak photoneutron yield from Ce^{144} + D is probably caused by a higher energy γ ray of low intensity.

1389

Iowa State College Ames Laboratory
RADIOACTIVITIES PRODUCED IN EUROPIUM AND GADOLINIUM. Richard Earl Hein. March 1950. 66p. (ISC-95)

A 236-day neutron induced activity in Gd purified by ion-exchange methods is assigned to Gd^{153}. A simple decay scheme is proposed in which the Gd^{153} decays to an unstable Eu^{153} by K-electron capture and then to the ground state by emission of the 106-kev γ ray. The γ ray is highly internally converted giving rise to K, L, and possibly M electrons. A 7.2 ± 0.2-day and 18- to 24-hr activity present in the neutron-irradiated Gd were separated on an ion-exchange column. The 7.2-day activity assigned to Tb^{161} decays by emission of 0.50-Mev β and 0.05-Mev γ. The 18- to 24-hr activity tentatively assigned to Gd^{159} decays by emission of 0.82-Mev β and γ rays of 0.05 and 0.42 Mev. Half-life measurements on Gd produced by deuteron bombardment of Eu extend over 600 days. The activity decaying with a half-life of 155 days initially is slowly lengthening into a longer half-life. A 265-kev γ ray is detected in addition to the 106-kev γ ray previously found in Gd^{153}. The 265-kev γ ray is assigned to Gd^{151} which decays with a half-life of 150 days. This half-life is based on ratios of the 106-kev γ ray to the 265-kev γ ray observed over a 600-day period. The decay scheme of Gd^{151} appears to be very similar to Gd^{153} with only the 265-kev γ ray present in the decay. Energy measurements on Eu^{152} and Eu^{154} produced by neutron and deuteron bombardment of Eu_2O_3 give highly similar results, indicating that the same ratio of isotopes is produced in the two irradiations. Half-life measurements on the combined samples of Eu^{152} and Eu^{154} extend over 550 days giving values of 6.6 to 8.5 yr. 42 references. (auth)

1390

University of California Radiation Laboratory
RADIOACTIVITY OF ASTATINE ISOTOPES. G. W. Barton, Jr., A. Ghiorso, and I. Perlman. Nov. 22, 1950. 29p. (UCRL-670(rev.))

A number of new neutron-deficient isotopes of astatine have been identified in the mass-number range 200 to 209 following the irradiation of bismuth with high-energy helium ions. Their α-decay properties fall in line with predictions for isotopes in this region with <126 neutrons, that is, the α energies increase with decrease in mass number. Because of the complexity of the isotopic mixtures, half-lives and mass-number assignments were made in most cases through the identification of decay products of lower atomic number. The decay properties as now known are summarized. (auth)

1391

A COINCIDENCE ABSORPTION STUDY OF THE DECAY OF ^{181}Hf. E. W. Fuller. Proc. Phys. Soc. (London) 63A, 1348-58(1950) Dec. 1.

The decay of 46-day Hf^{181} has been investigated by absorption coincidence techniques using an integral-type delayed-coincidence recorder, and a special counter with which the absorption curves of low-energy electrons may be obtained. The results confirm a previously published scheme for the main mode of decay, namely that a 400-kev β ray from Hf^{181} leads directly to the 20-μsec metastable state in Ta^{181}. This decays by emission of a 130-kev γ ray, followed by a 470-kev transition to the ground state. Instantaneous coincidences were found to involve the γ transitions in the main branch, electrons from γ rays of 87, 133, and 340 kev, and a β ray of approximately 440 kev. It is suggested that about 30% of the Hf^{181} nuclei in the 46-day state decay by a highly forbidden γ transition (133 kev) with an 87-kev γ ray in cascade to the ground state. This decays through a 440-kev β transition to an excited state (340 kev) of Ta^{181}. Half-life and conversion-coefficient values enable spins and relative parities to be assigned to each of the levels occurring in the decay scheme proposed. (auth)

1392

CORRELATION BETWEEN THE DIRECTIONS OF THE β PARTICLE AND THE γ QUANTUM EMITTED IN SUCCESSION. A. Z. Dolginov. Zhur. Eksptl'. i Teoret. Fiz. 20, 636-46(1950) July. (In Russian)

Angular correlation between β and γ rays emitted in successive transitions is examined for five variants of the β-decay theory. The calculation is made (1) for the allowed and for both the first and second forbidden β transitions, and (2) for any multipolarity of the γ quantum. Formulas of the angular distribution of the neutrino in the second forbidden transition are derived, and the influence of the coulomb field on the correlation is studied. (auth)

1393

THE INTERPRETATION OF COMPARATIVE HALF-LIVES IN THE FERMI THEORY OF BETA-DECAY. Eugene Feenberg and George Trigg. Revs. Modern Phys. 22, 399-422(1950) Oct.

The discussion is based on the fact that the ft product, or comparative half-life in the Fermi theory of β decay, provides a useful criterion for the classification of radioactive transitions as allowed or forbidden to various degrees (f is a theoretical factor which corrects the observed half-life t for the effects of the nuclear charge and the energy of the transition thus reducing all half-lives to a comparable basis). An appendix contains the general formulas for f and a description of calculation procedures. References to tensor coupling and axial vector coupling are included. 12 figures.

1394

MEASUREMENT OF THE SOFT PART OF THE β SPECTRUM OF THE RADIOACTIVE DEPOSIT OF THORIUM. L. Ya. Shavtvalov. Zhur. Eksptl'. i Teoret. Fiz. 20, 684-7(1950) Aug. (In Russian)

An examination of the soft part of the β spectrum of Th(B + C + C'') showed the presence of two conversion lines, 24.7 and 36.3 kev. Two very close γ lines of about 40 kev were found with the aid of a coincidence device. One is emitted by an excited ThC'' nucleus, the other by ThD. The 24.7-kev β line is due to an internal conversion of the γ lines in the L_1 shells of the corresponding nuclei. (auth)

1395

ON THE THEORY OF BETA-RADIOACTIVITY. I. THE USE OF LINEAR COMBINATIONS OF INVARIANTS IN THE INTERACTION HAMILTONIAN. S. R. De Grott and H. A. Tolhoek. Physica 16, 456-80(1950) May.

The theory of β activity, based on the use of a linear combination of all five relativistic invariants, is developed for allowed transitions. The interaction Hamiltonian is taken as $H_\beta = G \sum_{k=1}^{5} C_k J_k$ where the C_k are coefficients that determine the combination of the invariants J_k with 1 = scalar, 2 = vector, 3 = tensor, 4 = axial vector, and 5 = pseudoscalar. The formula for the shape of β^+ and β^- spectra is calculated, taking into account the nuclear charge Z. A general principle, viz., complete symmetry for the processes of β^+ and β^- emission is proposed, which has as a consequence that only two types of combinations can exist: (a) combinations of the invariants 1, 4, and 5, (b) combinations of the invariants 2 and 3.

1396

RADIOACTIVITY OF THORIATED TUNGSTEN WIRE. Itaru Nonaka and Shoji Tanabe. J. Phys. Soc. Japan 5, 398-402(1950) Nov.-Dec.

The β rays and the γ rays emitted by $MsTh_2$ and Th(C + C' + C'') were measured with G-M counters of thin aluminium wall (0.3 mm) and thick brass wall (2 mm), respectively. If some of the atoms of the foregoing elements, or their parents $MsTh_1$ or RdTh, evaporate away, some changes of the activity will occur after heat treatment. Thorium itself is in the form of the oxide and is considered to be difficult to evaporate, or even if it evaporates to some extent the reduction of the content will appear in the chemical analysis. Theoretical considerations, experiments on pure ThO_2 specimens, and experiments on thoriated tungsten ingots are reported.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1397

INTERACTION BETWEEN ACTIVATORS IN PHOSPHORS. Z. A. Trapeznikova. Doklady Akad. Nauk S.S.S.R. 74, 465-8(1950) Sept. 21. (In Russian)

Interactions between activators in phosphors were studied on SrS-Ce,Sm, and SrS-Eu,Sm. The presence of Ce or Eu modifies radically the luminescence spectrum of Sm. Since the quantities of rare earths are too small to alter noticeably the lattice of the main substance SrS, it must be surmised that the foregoing effect is due to an interaction between atoms of both activators at close distances. However, since their concentrations are very low, the probability of a close neighborhood being achieved by

random distribution is small. It is assumed that the two rare earths are present as parts of one complex anion. This hypothesis was confirmed in a study of the luminescence of Eu-salt solutions in the presence of Sm salts. Similar phenomena, bearing out the same hypothesis, were observed in ZnS-Sm by adding NaCl, NaBr, and Cu salts.

SHIELDING

1398

A CONTRIBUTION TO THE STUDY OF THE COMPOSITION OF CEMENTS; CALCIUM, STRONTIUM, AND BARIUM CEMENTS; trans. from Bull. sect. sci. acad. roumaine 30, No. 9, 1-7(1948). A. Braniski. 1948. 8p. (NP-2233)

It is noted that barium cements may be used wherever protection against penetrating radiation is required. Their absorption coefficient for such radiation is increased considerably by the heavy elements which enter into their chemical composition.

THEORETICAL PHYSICS

1399

ADDITIONAL CONSIDERATIONS ON THE DIAGONALIZING OF THE HAMILTONIAN IN THE THEORY OF WAVE FIELDS. B. Ferretti. Nuovo cimento (9) 7, 375-7(1950) May 31. (Letter to the editor; in Italian)

As shown by the author (Nuovo cimento (9) 7, 79(1950)), the Dyson-Feynman operator can be used for diagonalizing the Hamiltonian of coupled wave fields, if the interaction density is independent of the derivatives of the field operators. This procedure can be generalized so as to include physically more interesting cases in which such a dependence on the derivatives exists; use is made of the artifice employed by Kanesawa and Tomonaga (Progress Theoret. Phys. (Japan) 3, 1(1948)) in their treatment of the interaction between an electromagnetic and a meson field.

1400

APPLICATION OF FEYNMAN'S METHOD TO BREMSSTRAHLUNG. M. Cini and L. A. Radicati. Nuovo cimento (9) 7, 380-3(1950) May 31. (Letter to the editor; in Italian)

Through the application of Feynman's formalism (Phys. Rev. 76, 769(1949)), and of Wataghin's relativistic cut-off (Anais acad. brasil. cienc., 129(1943)), divergences are avoided in the treatment of interactions between electrons. However, if these procedures are more than a calculation artifice, and reflect a physical reality, their application to processes in which no divergences are encountered should lead to significant modifications of the usual views. In a preliminary work in this direction, Feynman's formalism was applied to the phenomenon of bremsstrahlung, with the result that, at high energies, a simultaneous emission of several photons (having a certain critical energy) becomes more probable than the emission of a single photon (with an energy approaching that of the incident electron).

1401

FLUCTUATIONS IN THE INTENSITY OF BIREFRACTED RAYS. D. Canals Frau. Rev. union mat. Argentina 16, 213-25(1950). (In Spanish)

Quantum electrodynamics permits the study of the fluctuations of the distribution of intensities in two rays emerging from a birefringent plate for any given number of incident photons. It leads for single photons to the elementary quantum theoretical description of the phenomenon, and for large photon numbers to the limit of the classical theory. The quantum theoretical part of the intensity fluctuations should be observable up to "intensities" (photon number) corresponding to 1000 photons. (auth)

1402

HIGHER APPROXIMATIONS OF RADIATION THEORY FOR THE KLEIN-NISHINA FORMULA. PART II. M. R. Schafroth. Helv. Phys. Acta 23, 542-6(1950) Sept. 1. (In German)

In Part I (Helv. Phys. Acta 22, 501(1949); NSA 4-1282) e^6 corrections for the differential cross section of the Compton effect were derived and the calculations carried through for the nonrelativistic boundary case. In the present paper the extreme relativistic case is considered. This is followed by an analysis of possible experimental verifications of the results.

1403

ON THE UNCERTAINTY PRINCIPLE. A. Gamba. Nuovo cimento (9) 7, 378-9(1950) May 31. (Letter to the editor; in Italian)

Born ("Natural Philosophy of Cause and Chance," Oxford, 1948) has given a very generalized demonstration of the uncertainty principle. It is shown here that Born's procedure can be used for the derivation of a more restricted inequality with which the uncertainty principle was expressed by Schroedinger, (Sitzber. preuss. Akad. Wiss., 296(1930)).

1404

QUANTUM-ELECTRODYNAMICAL SELF-ENERGY AND EXACT SOLUTIONS OF SCHRÖDINGER'S EQUATION. PART II. H. Salecker. Z. Naturforsch. 5a, 480-92(1950) Sept. (In German)

It has been shown in Part I (Z. Naturforsch. 5a, 431(1950)) that self-energy divergences in quantum electrodynamics are not due to perturbation calculations, but originate in the theory itself. The Schroedinger equation is represented here as an infinite system of first-order differential equations, the procedure being justified by the infinite number of degrees of freedom appearing in the quantum wave-field theory. Possible approaches for the exact solution of this system of equations, other than the perturbation method are considered. It is found that an exact solution can be obtained by using a special mathematical operation, called product integration, whose definition can be derived from an analogous product representation recently used by Tomonaga (Progress Theoret. Phys. (Japan) 1, 27(1946)) and Dyson (Phys. Rev. 75, 486(1949)). A discussion of the

peculiarities of the perturbation-theoretical solution shows that the striking agreement between the experiment and the first nonvanishing approximation in quantum electrodynamics was to be expected in the framework of that theory, but would not appear in the meson theories. (auth)

1405

RELATIONSHIP BETWEEN THE CLASSICAL AND THE QUANTUM EQUATIONS OF THE SELF-CONSISTENT FIELD. M. A. Mokul'skiĭ. Zhur. Eksptl'. i Teoret. Fiz. 20, 688-92(1950) Aug. (In Russian)

Certain several-body problems have been solved by the approximate method of the self-consistent field, developed by Hartree and Fok in the quantum mechanical domain and used in the classical domain by Vlasov (Zhur. Eksptl'. i Teoret. Fiz. 8, 291(1938)). Since Terletskiĭ (Zhur. Eksptl'. i. Teoret. Fiz. 7, 1290(1937)) and Blokhintsev (J. Phys. U.S.S.R. 2, 71(1940)) have shown that, if $h \to 0$, the Schroedinger equation becomes equivalent to the classical probability-density equation, it could be expected that Hartree's quantum equation of the self-consistent field passes into Vlasov's classical equation when h approaches zero. It is shown in the present paper that this is true.

1406

REMARKS ON A QUANTIZED-FIELD THEORY OF MATTER. Ya. I. Frenkel. Uspekhi Fiz. Nauk 42, 69-75 (1950) Sept. (In Russian)

It is stated that the puzzling duality of physical phenomena and their seeming indeterminism in modern theory could be removed only at the price of a radical rejection of any analogy between an elementary particle and a solid body, and by accepting the particle concept as a logical entity covering quantized dynamical properties of an otherwise continuous wave field in a continuous space-time.

1407

SINGULAR SOLUTIONS OF THE KLEIN-GORDON EQUATION TAKING INTO CONSIDERATION AN EXTERNAL MAGNETIC FIELD. Jules Géheniau. Compt. rend. 231, 610-12(1950) Sept. 25. (In French)

Several singular solutions of the exact Schroedinger relativistic equation for a charged particle in a uniform and constant magnetic field are derived.

PATENTS

CHEMISTRY

1408

CHLOROFLUOROHEPTANES. E. T. McBee (to U. S. Atomic Energy Commission). U. S. Patent 2,537,777, Jan. 9, 1951.

This patent describes a new class of halogenated organic compounds, the monochloro-, dichloro-, and trichloroperfluoroheptanes, and a number of methods of preparing same.

1409

CONTINUOUS SEPARATION PROCESS. H. H. Strain. U. S. Patent Application Serial No. 184,269.

A process is described for separating charged particles from a solution by employing a combination of electromigration and chromatographic techniques.

1410

DIBORANE PURIFICATION PROCESS. G. W. Schaeffer and G. D. Barbaras (to U. S. Atomic Energy Commission). U. S. Patent 2,533,696, Dec. 12, 1950.

Diborane is recovered from a mixture of diborane and ethane by treating the mixture with pyridine to complex the diborane and then removing the ethane by distillation. The diborane is then recovered from the pyridine complex by reacting it with a boron halide.

1411

ELECTROLYTIC CELL. S. G. Osborne (to U. S. Atomic Energy Commission). U. S. Patent 2,540,960, Feb. 6, 1951.

This patent describes an improved electrolytic cell for the production of fluorine wherein the anode assembly can be integrally removed from the cell without disturbing other structures therein. A novel unitary structure of diaphram members is also provided.

1412

FLUORINATION OF LUBRICATING OIL. A. F. Benning (to U. S. Atomic Energy Commission). U. S. Patent 2,541,190, Feb. 13, 1951.

This patent describes a process for stabilizing fluorocarbon compositions and eliminating their reducing properties by subjecting the fluorocarbon compositions in concentrated form to a finishing treatment in liquid phase and at an elevated temperature with silver difluoride, cobalt trifluoride, or manganese trifluoride.

1413

HYDROGEN PURIFICATION SYSTEM. L. D. P. King, R. E. Schreiber, and C. P. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,536,610, Jan. 2, 1951.

This patent sets forth a method and apparatus for purifying hydrogen by high-temperature diffusion through an unsupported layer of a metal which forms a hydride.

1414

MANUFACTURE OF FLUORINE BY ELECTROLYSIS. R. C. Downing (to U. S. Atomic Energy Commission). U. S. Patent 2,540,248, Feb. 6, 1951.

A fused alkali-metal–acid fluoride electrolyte is first subjected to a conditioning treatment by electrolysis, employing a nickel anode, and the conditioned electrolyte is then electrolyzed to produce fluorine, employing a carbon anode.

1415

PREPARATION OF COMPOUNDS OF URANIUM AND NONMETALS. A. S. Newton and O. Johnson (to U. S. Atomic Energy Commission). U. S. Patent 2,534,676, Dec. 19, 1950.

A process is described for preparing a compound of a nonmetal and uranium by reacting uranium hydride with the vapors of a compound of hydrogen and a nonmetal, such as S, Se, Te, N, P, As, C, or B.

1416

THE PREPARATION OF UF_6. R. M. Hainer (to U. S. Atomic Energy Commission). U. S. Patent 2,535,572, Dec. 26, 1950.

A method is described for preparing uranium hexafluoride by treating uranium tetrafluoride with anhydrous oxygen at an elevated temperature.

1417

PREPARATION OF URANIUM HYDRIDE. J. C. Warf (to U. S. Atomic Energy Commission). U. S. Patent 2,536,616, Jan. 2, 1951.

A method is described for preparing uranium hydride by reacting massive uranium with hydrogen at an elevated temperature and at a pressure in excess of the partial pressure of hydrogen from decomposition of the uranium hydride at the temperature employed, and finally cooling the reaction product while maintaining said hydrogen pressure.

1418

PROCESS AND APPARATUS FOR WATER DECONTAMINATION. R. A. Lauderdale, Jr., and A. H. Emmons. Patent Application Serial No. 208,421.

This application describes a process for decontaminating water which is contaminated with nuclear fission products or other radioisotopes by bringing the contaminated water into contact with steel wool, clay, activated carbon, an anion exchange resin and a cation exchange resin.

1419

PRODUCTION OF URANIUM HALIDES. O. Johnson and A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent 2,534,677, Dec. 19, 1950.

Uranium halides are produced by reacting uranium hydride at an elevated temperature with an elemental halogen, a hydrohalide, a carbonyl halide or a halogen substituted methane.

1420

RARE EARTH SEPARATION BY ADSORPTION AND DESORPTION. F. H. Spedding and A. F. Voigt (to U. S. Atomic Energy Commission). U. S. Patent 2,539,282, Jan. 23, 1951.

According to this process, immediately adjacent rare earths can be separated by first adsorbing a mixture of the rare earths from aqueous solution of their water-soluble inorganic salts, preferably chlorides, on a columnar bed of cation exchange resin, then passing a citric acid solution at a controlled pH through the resin column and collecting successive portions of the eluate.

ENGINEERING

1421

APPARATUS FOR MEASURING PRESSURE. E. T. Booth, Jr., S. Cromer, and F. L. Alexander (to U. S. Atomic Energy Commission). U. S. Patent 2,542,905, Feb. 20, 1951.

An apparatus is described for measuring the pressure of a corrosive fluid by establishing an inert fluid pressure at a value sufficient to balance the corrosive fluid pressure and measuring the inert fluid pressure as a measure of the corrosive fluid pressure.

1422

AUTOMATIC FLANGE SYSTEM. J. J. Goett (to U. S. Atomic Energy Commission). U. S. Patent 2,536,602, Jan. 2, 1951.

This patent covers a device for opening, closing, and sealing pipe joints and junctions by remote control. The device utilizes a flange provided with hydraulic clamps fastened to one of the pipe sections and capable of clasping a flange on another pipe section when actuated from a remote location.

1423

BEARING TEST APPARATUS. L. M. Headley (to U. S. Atomic Energy Commission). U. S. Patent 2,539,578, Jan. 30, 1951.

An apparatus is described which may be used for testing and visually observing the performance of thrust bearings under variable conditions of pressure and corrosion.

1424

LATCH MECHANISM. C. B. Graham and V. D. Carver (to U. S. Atomic Energy Commission). U. S. Patent 2,540,941, Feb. 6, 1951.

This patent describes an automatic liquid-dispensing nozzle which has a sensitive trigger mechanism for automatically shutting off the flow through the nozzle when the container into which the liquid is being dispensed is filled to a predetermined level.

PHYSICS

1425

ALTERNATING CURRENT GENERATOR. W. L. Ringland (to U. S. Atomic Energy Commission). U. S. Patent 2,539,273, Jan. 23, 1951.

A commutator-type dynamoelectric machine is described in which the armature circuit and the field circuit are coupled through suitable impedance means in a manner which causes the machine to generate alternating current.

1426

AMPLIFIER. I. R. Brenholdt (to U. S. Atomic Energy Commission). U. S. Patent 2,541,198, Feb. 13, 1951.

The amplifier described, particularly suited for handling minute currents, utilizes tubes whose filaments are supplied from a single high-voltage power supply with protective control circuits for preventing injury to the tubes due to voltage surges, changes, or abnormal conditions.

1427

APPARATUS FOR CHANGING THE ION SOURCE OF A CYCLOTRON. J. J. Livingood, R. A. Streeter, and J. V. Peters (to U. S. Atomic Energy Commission). U. S. Patent 2,531,065, Nov. 21, 1950.

An apparatus is described for automatically removing and replacing the cathode and anode of an ion gun in a cyclotron without the necessity of an operator being present in the cyclotron room and without losing the vacuum in the cyclotron.

1428

COLLIMATING SHIELD. R. D. Watt and W. N. Watson (to the U. S. Atomic Energy Commission). U. S. Patent 2,533,701, Dec. 12, 1950.

An apparatus is described for shielding against radiation from the beam of a high-energy particle accelerator while simultaneously providing an adjustable aperture for such beam through the shielding structure.

1429

COMBINATION BETA AND GAMMA CHAMBER. E. R. Tompkins (to U. S. Atomic Energy Commission). U. S. Patent 2,538,632, Jan. 16, 1951.

A system is described for continuously monitoring gases or liquids for both β and γ activity. The system is designed to withstand the corrosive action of such liquids or gases.

1430

DIRECT CURRENT NEGATIVE FEEDBACK AMPLIFIER. B. L. Weller (to U. S. Atomic Energy Commission). U. S. Patent 2,536,617, Jan. 2, 1951.

The circuit described is a degenerative or inverse feedback, direct-current amplifier including an electrometer tube which is particularly suitable for measuring small currents, such as those developed in a radiation-responsive ion chamber, and which is substantially devoid of transient instability.

1431

ELECTRONIC CIRCUIT. B. B. Rossi and H. H. Staub (to U. S. Atomic Energy Commission). U. S. Patent 2,541,940, Feb. 13, 1951.

This patent describes a circuit for accurately determining the current produced in an ionization chamber under steady-state conditions in relation to a zero point, while permitting continuous operation of the ionization chamber, by reducing the steady-state current to zero through the employment of a predetermined pulse of opposite sign, but equal in magnitude to the current.

1432

ELECTRONIC SWITCHES. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,535,886, Dec. 26, 1950.

An electronic switch of the gaseous discharge type is described having only two main elements to support and control its discharge and capable of passing hundreds of megawatts of pulsed power at a high repetition rate, without damage from high inverse plate voltage.

1433

FAST IMPULSE CIRCUITS. W. A. Higinbotham (to U. S. Atomic Energy Commission). U. S. Patent 2,536,808, Jan. 2, 1951.

A circuit for translating the rate of occurrence of electrical impulses into a known fractional rate is obtained by the combination of known types of trigger circuits with a novel form of commutation and interlocking system.

1434

ION VACUUM GAUGE. S. M. MacNeille (to U. S. Atomic Energy Commission). U. S. Patent 2,537,775, Jan. 9, 1951.

This invention relates to a method and apparatus for ascertaining the pressure of a gas by noting the relationship between electrons bombarding the gas and the ionization resulting therefrom.

1435

RADIATION DETECTOR. E. O. Wollan and L. A. Pardue (to U. S. Atomic Energy Commission). U. S. Patent 2,536,991, Jan. 2, 1951.

This pocket-type ion chamber has a response characteristic which is substantially independent of the humidity of the surrounding atmosphere and which is accurately indicative of the physiological damage caused to living tissue.

1436

RADIOGRAPHY. P. Morrison (to U. S. Atomic Energy Commission). U. S. Patent 2,541,599, Feb. 13, 1951.

An improved filter and intensifying screen for use in x- and γ-ray radiography is described. In one embodiment, a sheet or foil of uranium metal is placed between the photographic film and the article being radiographed for the dual purpose of absorbing secondary radiations and intensifying the photochemical effect of the film emulsion.

1437

SAMPLING APPARATUS. S. L. Handforth (to U. S. Atomic Energy Commission). U. S. Patent 2,540,944, Feb. 6, 1951.

This patent covers a sampling apparatus particularly adapted for use in connection with processes involving large bodies of radioactive liquids, which will make available small, representative samples of the body of liquid without risk to personnel.

1438

VOLTAGE REGULATION AND SUPPLY. D. K. Froman (to U. S. Atomic Energy Commission). U. S. Patent 2,535,355, Dec. 26, 1950.

The voltage-regulating system described obtains increased stability of operation from the fact that the control voltage for the controlled tube, derived from a vacuum tube as an impedance element, is not affected by terminal voltage variations except in a predetermined manner.

AUTHOR INDEX

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